COMPUTERWORLD

Our 1000th Issue

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THE NEWSWEEKLY FOR THE COMPUTER COMMUNITY

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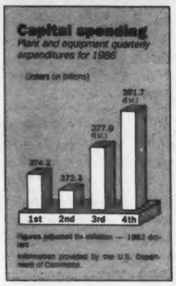


Comdex Preview
Coverage begins on page 17

Executive Report
1,000th Issue of *Computerworld*/**145**

Special Section
40th Anniversary of Computing, follows page 264

'Open' nets trigger fears

Specter of regional protocols looms as giant headache

By Mitch Betts

HERNDON, Va. — Communications users last week expressed fears that the seven regional holding companies may develop incompatible Open Network Architectures that will complicate the building of private networks in the 1990s.

Edward Youngberg, director of telecommunications for the Prudential Insurance Co. in Roseland, N.J., said he is worried that a lack of standard transport protocols will increase costs for equipment, staff expertise and software and complicate operating procedures as well as hamper the diagnosis and resolution of network problems.

"Whatever price savings I get from the divested Bell operating company will be offset by headaches and operational grief" from trying to connect to the network, said Youngberg, who attended a meeting on the ONA issue.

The Federal Communications Commission, in its Third Computer Inquiry order [CW, May 19], required the holding companies to submit ONA plans by February 1988 that will make their local networks accessible to enhanced service providers and users. In return, the regional holding companies will be allowed to offer enhanced services integrated in their local networks, rather than through separate subsidiaries.

"We have an overall concern that we may end up with seven separate, incompatible ONA plans," said Brian R. Moir, the Washington, D.C.-based counsel for the International Communications Association, the largest users group. At an industry group meeting in Herndon, Moir said that

See **OPEN** page 15

MIS: 'Treat end users as customers'

By David A. Ludlum

ATLANTA — Serving the end user and managing the dispersement of data are the crucial concerns for information systems management, executives said here last week during the Data Processing Management Association's 35th annual conference.

Users, who "used to be the bane of our existence," pay the corporate bills and therefore deserve to be treated as customers, said Walter McCormick, information systems manager for Wheel Trueing Tool Co. in Columbia, S.C., a manufacturer of diamond drilling and cutting devices. Furthermore, McCormick said, "We can no longer snow them with a bunch of buzzwords." His chief goal, McCormick said, is easing, and even instigating, the transition to end-user computing.

McCormick said he has been putting data out where it belongs — with the users — and has reduced his staff from 32 to 12 in the process. "The future is in information management, not data processing," he said.

Owen L. Waltman Jr., an accounting systems analyst for the Commonwealth of Virginia, said his attention is focused on decentralization, particularly with the movement of development work to personal computer-based workstations and greater involvement of end users in the development work.

But Waltman's chief concerns are issues arising from that trend, such as ownership, management and access to dispersed data. "Technology has made new techniques available. People say, 'I can do this,' but others say, 'No you can't,'" he said.

Integrating systems that are already dispersed was the top issue cited by Guy A. Fontaine, data processing planner for

See **END** page 6

TOP OF THE NEWS

Applied Data Research last week said it will eliminate 100 positions during the next three to four months. Some of those positions will be cut through attrition, company officials said.

See **NEWS** page 9

Italian PC ally gets AT&T call

By Alan Alper

NEW YORK — AT&T last week turned to its European partner, Ing. C. Olivetti & Co., to direct its foundering efforts in the low-end computer products market.

AT&T installed Vittorio Cassoni, president of Olivetti Management of America Corp., as senior vice-president of its newly formed Data Systems Division. It also assigned Olivetti & Co. complete responsibility for the development and production of its personal computers and gave the Italian firm an increased role in marketing its data products in Europe.

The Data Systems Division is an organization that absorbs the former Computer Systems Division while adding responsibility for vertical market applications. Cas-

See **ITALIAN** page 4

CW SPECIAL ISSUE

Serving the computing professional

As our cover enthusiastically states, this week marks the celebration of the 1,000th issue of *Computerworld*, the voice of the computing community.

To commemorate this milestone, we are presenting our largest issue ever in a collector's edition format. You will find a special pullout section celebrating the 40th anniversary of computing, containing observations from leaders in society, industry and politics, ranging from President Ronald Reagan to writer Isaac Asimov.

Computerworld has prepared a special Executive Report: 1,000th Issue, beginning on page 145, in addition to our regular weekly news sections. This section includes a personal message from Patrick McGovern, founding publisher, as well as reports from our news staff on the crucial issues swirling around the management of information systems.

We at *Computerworld* take great pride in our record of serving the ever-changing computing profession. In this regard, we want to give special thanks to our many thousands of loyal readers, who at various times have also served us as key sources.

We trust you will enjoy this special issue, which, like the 999 issues before it, remains the outspoken advocate of computing professionals.

NEWS

Users opting for in-house integration

By Jeffry Beeler

PALM SPRINGS, Calif. — When the U.S. Department of Agriculture (USDA) resolved recently to integrate its nationwide collection of 22,000 processors, the agency delegated as little of the task as possible to independent contractors.

Instead, the USDA decided to do the bulk of its systems integration work in-house, according to Kenneth Lini, communications branch manager for the department's Fort Collins, Colo., Computer Center.

"We see ourselves as our own systems integrators and will never again turn that role over to any vendor," Lini said here last week at Framingham, Mass.-based International Data Corp.'s Fall Executive Conference.

For many of the conference's other attendees, the USDA's actions illustrated an important principle — that user organizations themselves must ultimately assume responsibility for integrating their own systems, even in instances where a certain amount of vendor assistance may prove absolutely necessary.

"Unless a user commits to tying its incompatible systems together itself, the job will probably never get done," Lini said.

Despite glowing advertising claims to the contrary, no vendor has licked the systems integration problem entirely. At best, commercial communications products "address only a piece of the problem — and sometimes a piece that doesn't need solving at all," according to Network Strategies, Inc. Chairman Richard Deal.

Integration at poultry plant

Ray Lollar, vice-president of systems services at Goldkist, Inc., an Atlanta-based farm cooperative, said that in six to nine months, he plans to begin integrating a central IBM 3083 with the IBM System/36s that Goldkist runs in its eight poultry processing plants and other locations.

Exactly how the company intends to implement its plan has yet to be decided. But on at least one major detail, Lollar's thinking is already clear: Whatever technology Goldkist eventually adopts to enable its System/36s to transfer files to the 3083, the integration effort will be undertaken primarily by the company's own employees rather than by outsiders, he said.

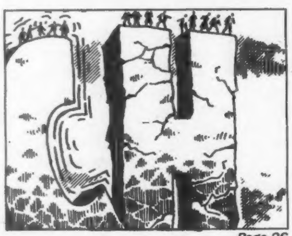
Ironically, perhaps the most serious of these difficulties "has nothing to do with technology," according to Tom Durrell, national sales director with Electronic Data Systems Corp. (EDS). "The biggest problem in integrating systems has to do with people and their attitudes."

A convenient case in point is EDS's own parent company, General Motors Corp., which brims with competing "fiefdoms that have vested interests and want everything done their own way," Durrell said. "The engineering department may want its own proprietary computer-aided design system and doesn't care whether it talks to manufacturing."

Our 1000th Issue

SPECIAL 40TH ANNIVERSARY ISSUE

NEWS



Page 26

SYSTEMS & PERIPHERALS

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EXECUTIVE REPORT: 1000TH ISSUE

Page 145

OPINION & ANALYSIS

DEPARTMENTS

Design and photography of protective cover and first inside cover by P. Charles Ladouceur.

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Lotus graphics release eases beta user's tasks

Package results from acquisition strategy

By Douglas Barney

CAMBRIDGE, Mass. — Lotus Development Corp. is scheduled to announce today Freelance Plus, a $495 version of its graphics software that includes charting capability and tighter integration with the company's 1-2-3 and Symphony.

As a means of moving into the graphics marketplace, Lotus acquired Graphic Communications, Inc. (GCI), developer of Freelance, in June. "In some ways, Freelance Plus is the product that Lotus acquired GCI for," said Dave Tarrant, general manager of Lotus's Graphics Products Group.

One beta user contacted by *Computerworld* was impressed with the product. "The interface is typically Lotus-like, and it is a good intuitive interface," commented Merv Adrian, senior programmer analyst for Shearson Lehman Brothers, Inc. in New York.

Ease of use is a key strength of the product, according to Adrian. "Although I have been working through the documentation, anybody who is comfortable with personal computer software, and especially anyone who has ever used a Lotus product, can play their way through it. It doesn't take a rocket scientist to figure out how to do something," Adrian said.

Import capability

Besides ease of use, the package includes an enhanced import capability. "You can import directly from 1-2-3 or Symphony or Graphwriter," Adrian said. The product will also import Ashton-Tate's Dbase files and ASCII text files and can output a Graphics Software Systems, Inc. GSS metafile to allow the use of Freelance graphics with popular desktop publishing packages, Tarrant said.

According to Tarrant, the use of Freelance with a word processing package, such as the recently announced Manuscript from Lotus, can provide a comprehensive desktop publishing solution.

"The sizzle of desktop publishing is really graphics. What desktop publishing does is allow you to merge text and graphics on a single page. Manuscript allows you to do that, and other products are starting to let you do that," Tarrant said.

Lotus also announced that it has consolidated its Graphwriter software line. Rather than the three versions of Graphwriter that were formerly available, only one version will be offered, and it will sell for $495. Graphwriter, a series of charting packages, was also developed by Graphic Communications.

A series of companion products, called Freelance Maps, will be available for $145 per set, $395 for a complete set. Freelance Plus will be available this month, according to Lotus. In a departure from Lotus's traditional approach, Freelance Plus is not copy protected.

The product requires an IBM Personal Computer or compatible with at least 384K bytes of random-access memory and a Hercules Computer Technology, Inc. Graphics Card, IBM Color Card or IBM Enhanced Graphics Adapter.

Italian PC ally gets AT&T call

From page 1

soni assumes responsibility for the development and marketing of computers, workstations, terminals and local-area networks, duties previously handled by James Edwards, senior vice-president of the Computer Systems Division, who was reassigned.

The strengthening of the alliance with Olivetti comes amid speculation that AT&T is considering an exit from the computer business after a nine-month pretax operating loss that is said to total $500 million and could reach $800 million before the year is over. It also follows hints from AT&T during the last few months that it is scaling back efforts to sell stand-alone systems in favor of a data networking strategy that leverages its communications strength.

In a prepared statement, AT&T President Robert Allen said the strengthening of the firm's alliance with Olivetti is "solid confirmation of our desire to address both domestic and international markets as we develop and deliver a new generation of data networking solutions."

AT&T, which owns 23% of Olivetti, has the option to increase its holdings in the Italian firm to 40% by 1990. An AT&T spokesman said the closer ties between the two companies should not be interpreted as an indication that AT&T intends to exercise its option anytime soon.

Last week analysts said they had long expected Olivetti to become a vital cog in AT&T's information systems strategy. "Olivetti had been unhappy with AT&T's performance in the personal computer area and had put pressure on them to play a larger role," noted Fritz Ringling, an analyst with the Gartner Group, Inc. in Stamford, Conn. "AT&T acquiesced by bringing in an Olivetti guy to handle product management."

Ringling sees a triad strategy evolving at AT&T Communications and Information Systems as it pertains to data networking.

Olivetti will be responsible for office products, such as personal computers and word processors. AT&T, by virtue of its networking equipment and services strengths, will handle data management and movement, while another partner, perhaps Fujitsu Ltd. of Japan, will provide mainframes to handle data processing, Ringling said.

If AT&T aligns itself with a mainframe manufacturer such as Fujitsu, Ringling said it could spell the end of the firm's attempt to market the 3B line of minicomputers to commerical users. "The 3B would revert to what it was developed to be: a system for switching or special applications for phone companies such as credit card billing," Ringling said.

Olivetti's enhanced role more than likely means an end to AT&T's relationship with Convergent Technologies, Inc., the San Jose, Calif., supplier of the less-than-successful Unix PC, analysts speculated. AT&T, which earlier this year committed to $90 million worth of Unix PCs, is believed to have sold fewer than 5,000 of them, sources said.

AT&T's reassignment of Edwards comes one week after the firm realigned its Data Systems Division along marketing and product development lines to better effect the integration of its recently merged Communications and Information Systems units. Group Vice-President Bill Marx is directing all marketing strategy, product management and customer technical support, while Jack Scanlon is responsible for all product development.

Edwards is responsible for developing plans for future delivery systems, an AT&T euphemism for how it intends to sell, service and support products within the targeted markets of its data networking strategy. He reports to Randall Tobias, AT&T vice-chairman and chief executive officer of AT&T Communications and Information Systems.

The AT&T spokesman said Edwards' position is not a demotion but "is considered an important job in our new data networking strategy."

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NEWS

MIS: 'Treat users as customers'

From page 1

Environment Canada, the nation's federal environmental department based in Hull, Quebec.

The department is attempting to establish standards and integrate office automation, telecommunications and data processing systems among its disparate collection of largely autonomous agencies, such as the wildlife, weather and parks authorities. "That is a big problem," according to Fontaine, who was reassured that others at DPMA were working on similar efforts.

> *Technological changes are coming so rapidly that it is hard to know what is on the market and when to move into new tools such as fourth-generation languages and relational data bases.*

Some conference attendees were more preoccupied by traditional concerns, such as keeping abreast of constantly changing technology — reflecting a theme of the gathering — and the hiring and motivating of computer professionals.

Technological changes are coming so rapidly that it is hard to know what is on the market and when to move into new tools such as fourth-generation languages and relational data bases, said Joao Leite, systems manager for the group insurance division of The Citadel General and Life Assurance Cos. of Toronto. "I'm not so sure that [using them] is as easy as the vendors say," he said.

Leite is concerned with keeping workers motivated and with the demands of information systems recruits, who he says want a clear career path. "If you want to hire quality, you do have to plan that properly," he said.

Bill Oshel, an employee relations supervisor with BASF Corp.'s Fibers Division in Williamsburg, Va., also was concerned with hiring and motivating DP professionals.

Oshel said recruits are interested in what a company can do for their careers. "It used to be you just knew computers were a good field to get into," he said.

Oshel said he also has to respond to established employees with similar anxieties. Those employees, he said, are worried about career directions brought about by changing technology and corporate restructurings and are wondering whether to remain in technical work or move into other functions.

DB2 users target of CCA Model 204 product upgrade

By Charles Babcock

CAMBRIDGE, Mass. — Attempting to broaden the appeal of its Model 204 data base management system (DBMS), Computer Corp. of America (CCA) last week introduced an enhanced version with the ability to communicate with IBM's DB2.

Under Release 9.0 of Model 204 and its associated User Language, a customer can mix data from DB2 with data from Model 204, said Berl M. Hartman, vice-president of Model 204 development. The data can be mixed in an application developed in User Language, CCA's fourth-generation language, which can now include queries written in IBM's SQL.

User Language applications may now update DB2 files as well, Hartman added.

CCA also announced that it intends to allow Model 204 to coexist in a DB2 shop by giving it the capability to process SQL statements, like DB2. That feature will come in Release 10, slated for a late 1987 or January 1988 debut, Hartman said.

Release 9.0 of Model 204 and User Language will be available in December at a price of $125,000 to $200,000 for the DBMS and $40,000 to $130,000 for Workshop/204, which includes User Language.

The release of User Language includes the ability to execute LU6.2-type verbs, such as SEND, RECEIVE and OPEN. This command set allows an application written in User Language to automatically engage in communication with DB2 for files or with another application, such as a business graphics package. Under current capabilities, Hartman said, a User Language application could download files from DB2, mix them with files from Model 204 and ship them to the graphics application.

CCA spokesmen call this process-to-process communications and said it allows cooperative processing between two applications. In addition to being governed by a User Language application, the process-to-process communications must take place either within IBM's CICS or its CMS Exec, the macro-level language used under VM/CMS environment.

Although User Language can now invoke basic LU6.2-type protocols that govern the communication, CCA spokesmen added that Release 9.0 represents a limited implementation of LU6.2, with many capabilities still absent.

Hartman said, however, that the capability represented a step forward from the reliance on subroutine calls and returns of other data base management systems. "It's the difference between leaving a message on an answering machine and talking to the person you called," she said.

There are other features of Release 9.0. Model 204 previously relied on a hashing index structure that provided efficient access to random data. An ordered index has been added to provide more efficient access to data in sorted sequence.

Model 204, which previously included text handling features in a special Text/204 version, has been given pattern-matching capabilities for data retrieval based on patterns of words and letters.

Release 9.0 can create a pause within which the data base can be dumped to create a backup and then resume operation without an interruption of the transaction stream. The recovery feature allows a DBMS to operate 24 hours a day without creating a hazard from lack of backup, Hartman said.

Release 9.0 provides interfaces to external security packages, including IBM's RACF and Computer Associates International, Inc.'s CA-Top Secret.

MIS execs predict rise in system spending

CW survey shows staff plans to stay constant

FRAMINGHAM, Mass. — A majority of top MIS executives expect spending for hardware and software to increase during the next 12 months but expect no increased hiring during the same period, according to a recent *Computerworld* survey.

In a telephone survey of 100 members of the newly formed *Computerworld* Editorial Board of Information Managers, 59% said they expect hardware spending to increase during the next 12 months, while 58% expect software expenditures to increase.

Only 5% of the executives said they expect outlays for software to decline, while 16% said they expect hardware expenditures to decline. Several said expenditures will increase owing to acquisitions of other companies.

Regarding the expectation of increased spending for software, one executive observed, "That's the direction IBM is taking us." Another executive claimed to be presently saturated with hardware.

The area of decentralized data processing appears to be one major area of increased spending. Fifty-nine of those contacted by CW's staff said they will increase outlays in that area. Only eight said they expect a decrease for decentralized DP.

But the executives, who represent a broad cross-section of the U.S. business community and include corporate-level officers at some of the largest U.S. companies, offered a far different view for the personnel situation ahead.

A majority of the respondents said the number of professionals employed will remain constant during the next 12 months. Thirty executives said they expect reductions in staffing for operating, data entry and control positions. Only 33% of the survey base said they expect to increase hiring of analysts and programmers. One executive, anticipating increased hiring, said data entry staff will decrease nevertheless "because users will enter data on-line."

Spending remains level

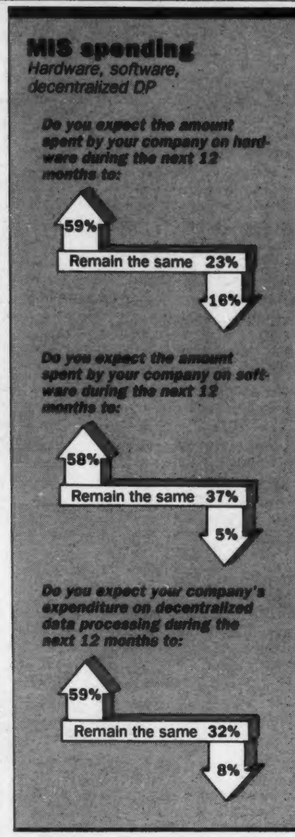
Comparing their current budgets with those of a year earlier, 32% said spending is about the same at the present time as in the previous budget period, while 52% said they are operating on an increased spending level. Looking ahead, 56 executives said they expect their next fiscal-year budget to increase, while only 12 said they expect a decrease.

Third-party specialists appear headed for disappointment in the year ahead. Only 24 of those surveyed said they expect increased spending for outside consultants and DP subcontractors. A full 30% said such spending will decrease in the year ahead, while 43% said the spending level will remain the same. "That's the area where we are cutting," one respondent said.

Leasing vs. purchasing produced an even split among respondents. Asked which method will take precedence over the next 12 months, 48 said purchase and 48 others said leasing. Some of those responses were conditional, with executives saying they are still not clear on the impact that recently enacted federal tax law changes will have on equipment purchases.

Several respondents also said they will purchase lower cost items and lease more expensive products; for example, several said they purchase only personal computers, one said he purchases only terminals and peripherals and another said he purchases anything priced under $500,000.

On a more personal note, 73 respondents said they expect moderate salary increases between 5% and 9% for themselves during the coming year. Fifteen had expectations of receiving less than a 5% increase and seven expected to receive between 10% and 14% above their current salaries. Only one expected more than 14%, explaining that because of the situation within his company, he will be taking on additional responsibilities and a new title and will be compensated accordingly.



Company claims Unix E-mail solution under SNADS

But users skeptical about protocol's value

By Elisabeth Horwitt

SAN JOSE, Calif. — Targeting companies that need to provide electronic mail exchange among a large number of IBM and non-IBM systems, Communications Solutions, Inc. is unveiling today a software package that implements IBM's Systems Network Architecture Distributed Services (SNADS) on Unix-based computers.

Access/SNADS provides a base to build a multivendor network using SNADS, a store-and-forward communications protocol that runs on top of IBM's LU6.2 peer-to-peer networking system.

Where SNA communications requires that simultaneous active sessions be set up on sending, receiving and all intermediate nodes, SNADS accepts the responsibility for delivering the information, queuing up data and sending it when the connection is ready, said Communications Solutions senior communications architect John Pickens. This makes SNADS more suitable than SNA for transmitting a document to multiple destinations, he added.

Written for systems running AT&T's Unix System V, the package could be useful to corporations that want to link their Unix-based scientific and engineering systems to IBM, said David Passmore, group manager of network architectures at Network Strategies, Inc., a consulting firm in Fairfax, Va. Such companies are often divided into "armed camps, one using Unix, the other SNA, with MIS having a hard time straddling the two," he added.

Several MIS managers interviewed by *Computerworld* had problems similar to those described by Passmore but, for different reasons, did not see SNADS as the right solution.

J. C. Penney Co. evaluated several SNA/LU6.2 products, including those from Communications Solutions, but concluded that the necessary applications software is still several years away, said William Friel, vice-president and director of systems and data processing. "Everybody claims that they have full, cross-system, transparent LU6.2 networking solutions, but we found nothing out there that we don't have already," he added. The company has turned to other possible methods to network its extensive installations of IBM and non-IBM systems.

Westinghouse Electric Corp. is in a similar bind. "We have two communities, engineering and business, which usually exist with a wall in between," said Robert Hodgson, manager of computing and communications.

The company is currently searching for software tools to enable employees to use the same terminal to access both business and engineering hosts. It has only a limited need for the multivendor, multihost document distribution capabilities offered by Access/SNADS, Hodgson said. A gateway now under development at Westinghouse will link IBM Professional Office System (Profs) and a Digital Equipment Corp.-based electronic mail system.

Standard features for Access/SNADS include intermediate node routing, flexible transmission scheduling and concurrent support of a variety of IBM communications protocols including 3270 terminal emulation, 3770 remote job entry, Document Interchange Architecture and Advanced Program-to-Program Communication (APPC).

Also standard is a basic Unix-based electronic mail system that can be linked with a full range of IBM document distribution systems, including Distributed Office Support Software, Personal Services and Profs. A multiuser Unix system can act as gateway between IBM Personal Computers running APPC/PC or Personal Services/PC and a SNADS network.

Access/SNADS runs in conjunction with Communications Solutions' LU6.2 software. Availability is scheduled for March 1987. Quantity pricing is $400 per node.

TOP OF THE NEWS

NEWS from page 1

Data General, ending a fiscal year it would like to forget, last week reported losses of $26.3 million, or 96 cents per share, for the quarter and $29 million, or $1.07 per share, for the year.

Most of the loss was attributed to the $30.9 million payment to Fairchild Semiconductor Corp. in the fourth quarter to settle Fairchild's 7-year-old antibundling lawsuit.

■

Addressing the problems of adolescent and adult illiteracy, IBM last week announced a computer-based system, Principle of the Alphabet Literacy System, designed to improve skills of those who read below the fifth-grade level.

■

Symbolics, Inc. reported an $18.8 million operating loss for its first quarter ended Sept. 28, its first loss as a publicly held company.

Service plan details emerge while IBM competition reacts

Third-party vendors ponder strategy, impact

By Jean S. Bozman

IBM's recent decision to offer a generally available discounted maintenance program to its customers is an attempt to prevent independent maintenance providers from encroaching on IBM customer accounts, competitors said last week.

Even though IBM had offered few details of its Corporate Service Amendment (CSA), its prime competitors, TRW, Inc.'s Customer Service Division and the Sorbus, Inc. division of Bell Atlantic Corp., viewed the program as an attempt by IBM to block them out of new accounts. However, executives at those firms said they were confident their sales will not be affected.

At TRW, National Sales Manager Lee Schelin said he is not terribly concerned that CSA will push his firm out of large accounts — or small ones. "I don't think it will have much of an impact on our sales," he said. "IBM is just trying to meet TRW or Sorbus's list price, but they're asking the customer to do extra work. So, we're still dealing with an apples and oranges situation."

So far, third-party maintenance companies generate just 5% as much revenue as IBM's annual maintenance revenue, which is estimated at about $4.5 billion. Sorbus and TRW each generate about $190 million a year in U.S. maintenance sales, according to industry estimates. Other third-party maintainers, including Control Data Corp., trail behind the two leaders.

Threat to multisite accounts

Far more significant than the threat of revenue lost to competitors, according to Louis J. Ross, president of Sorbus, is the third-party maintainers' threat to IBM control of IBM multisite accounts. That is because TRW, Sorbus and others represent a one-stop solution to maintenance.

While IBM will only maintain IBM machines, third-party firms agree to provide coverage of all machines, even if they include Digital Equipment Corp., Burroughs Corp. or Sperry Corp. In addition, the third-party companies provide equivalent service at discounts of 20% to 30% off IBM list price.

IBM spokesmen last week finally provided details of the plan. CSA is a rider to the IBM customer's existing IBM Maintenance Agreement, IBM said. It allows customers a range of discounts, provided the customer agrees to "perform certain cost-avoidance systems management tasks." Customers may apply for a three-year or one-year CSA agreement, but IBM reserves the right to determine whether the customer qualifies for it.

This general offering is a highly customized agreement between IBM and its customers. "It is very complex in its requirements, and the agreement will be slightly different for each customer," an IBM spokeswoman said.

The cost savings range up to 16% for IBM 3080 mainframes, for example, provided the customer signs for a three-year term. Three-year CSA agreements offer discounts that are 10% better than one-year agreements. IBM is not offering any two-year agreements.

Discounts also vary by the type of machine covered. The newer 3090 series of mainframes, for example, carries single-digit discounts rates under CSA, while the older 3080 models carry double-digit rates. Shops that have mixed-vendor environments may apply for the CSA plan, but only the IBM machines in those shops will be maintained.

Customer must agree to inspections

The key to the plan, IBM says, is that the customer must agree to on-site inspections of all locations being considered for CSA. If the customer has 15 locations and would like to have all of them covered under CSA, then he must pay IBM for 15 separate on-site inspections. The inspections, intended to determine whether the customer has adequate troubleshooting capability, cost $3,500 for each systems on-site inspection and $8,500 for each network on-site inspection.

IBM will reserve the right to deny the customer CSA coverage, based on these inspections. But IBM will offer to reinspect any site that fails within 90 days — at no extra charge. How will customers know if they have qualified? "It's no mystery," one IBM spokeswoman said. "Customers are given detailed requirements of systems management control procedures, which they must implement in order to qualify."

Should the customer decide to exclude certain sites or certain machines from CSA agreement, IBM will allow the exclusions. But there is a penalty for withdrawal from the CSA plan.

Although the program locks in discounts for maintenance fees, it does not lock in the base price on which those discounts are based. However, the customer may withdraw without penalty should IBM raise maintenance fees by more than 7% in the first year, by more than 14% in the second year or by more than 21% during the third year.

Last week, IBM commented that now that it had officially announced CSA, it was up to individual customers to contact their account representatives for full details.

Bozman is a Computerworld *contributor based in Chicago.*

NEWS

VM users see evolving role in dual operating system strategy

Cite end-user benefits, software development

By Rosemary Hamilton

The IBM VM operating system is emerging with a critical role alongside the vendor's MVS flagship operating system for the 370 environment, according to users and industry analysts.

With MVS presiding over the batch and transaction processing environment, VM will eventually serve as the operating system for end-user computing and software development as well as play a major role in communications for IBM large systems, users and analysts predicted.

A key indication of VM's importance in the IBM 370 line of computers can be seen in its positioning with the recently announced mid-range 9370 Information System. The vendor is offering four versions of VM/SP with the 9370, and users can also run MVS, VSE and VS1 on the new systems as guest operating systems under VM.

"I think their direction is to make VM truely equal to MVS in terms of a strategic product," said Mark Turpin, a consultant analyst in the operations department of Southern Company Services, an arm of The Southern Co., an Atlanta-based utility holding company. "We see the coexistence of the two products. Our feeling is MVS can't provide the level of interactive support that VM can, but MVS is there for batch runs and on-line transaction processing."

Industry analysts agree with Turpin, predicting that VM will stand with MVS as the two key operating systems of the future. Users who currently manage their shops with both operating systems said they see VM's role expanding.

At the American Can Co., supervisor of VM technical support Randall Porter said the VM enhancements will benefit both end users and programmers. He expects VM to become increasingly important for both end-user computing and software development. The company operates an IBM 3033 under VM/SP Release 4 and both a 3083 and a 4381 under MVS. By year's end, the company will have ported VM/SP Release 4 to the 4381 to be used for programming and end-user support, Randall said. The 3083 will continue running MVS for batch-oriented applications.

In the past, programmers have done MVS development and testing on the VM system, Porter said. New VM features such as windowing, which will be included in VM/SP Release 5, are expected to increase programmer productivity.

End-user applications

Additionally, there are a series of new features, such as an easier logon method, that will be important to end users, Porter said. American Can has installed many of its end-user applications, such as analysis and forecasting software from the SAS Institute, Inc., running on its VM systems.

Turpin at Southern Company Services also discussed the use of both MVS and VM at his facility and how VM plays an important role in his organization's decentralized approach. The utility holding company currently has two systems, an IBM 3090 Model 200 and an Amdahl Corp. 5880, running MVS in the corporate data center.

The 3090 handles batch processing, and the 5880 is used for on-line transaction processing. Meanwhile, there are 10 VM systems, ranging from the 4331 to the 3083 in data centers throughout the organization.

"The VM systems are distributed throughout the organization, at the operating companies and at the nuclear power plant," Turpin said. "They're used for on-site computing and serve as sort of a front end to corporate, giving access to the batch environment."

VM was selected over MVS for various Southern Co. facilities because "we found in an IBM TSO environment we were restricted. We couldn't provide the support or do the program development that we needed to," he said. "This provided computing access to the users and provided more security to the MVS system."

Another user of a strictly VM shop said his company may eventually add MVS to handle transaction-oriented applications, freeing up VM to better manage all other procedures.

"Nothing is firm yet," said Gene MacAdams, manager of IBM technical support at Northern Telecom, Inc., "but there is the potential to add MVS." Currently, MacAdam's facility uses a 3084, a 4381 and three 4341s, all running VM/SP Release 3. "VM is used for all our interactive and batch processes," he said. "That's not to say that MVS might not do better in batch, but what VM is doing, it's doing very well."

Analysts also expect VM to evolve as a communications-oriented operating system. "IBM is positioning VM as the operating system to handle communications facilities," said Clare Fleig, an analyst with the International Technology Group in Los Altos, Calif.

The new release of VM/SP includes the Transparent Services Access Facility, which Fleig said provides "core operating support for non-IBM environments."

NEWS

Common meeting draws improved reviews for IBM systems

Open query file is biggest success

By Jean S. Bozman

IBM small systems users are generally pleased with IBM's June and October enhancements to the System/36 and 38 line, judging from their reaction to the recent Common users group meeting in Dallas.

Usually, Common's renowned sound-off sessions are forums for complaints about hardware failures and software bugs. At each Common meeting, users give their views to managers from IBM's Rochester, Minn., plant, which makes the System/36 and 38 computers. But this time, those who attended the IBM users' meeting say customers seemed satisfied with the improvements.

"The enhancements show that IBM has been going back to Rochester with a list of things users have said at Common meetings and doing something about them," says Albert Barsa Jr., president of the New York-based Barsa Consulting Group. "There was a lot of satisfaction with the Release 8.0 of the System/38's Control Programming Facility operating system," he added, particularly with a new open query file feature.

This file feature, announced in June, was explained by management from IBM's Rochester plant. According to Barsa, they indicated the feature may be the precursor of more SQL-like query features for the System/38. Another feature that is on the way for the System/38 is remote software diagnostics, which will come online by mid-1987.

Such hints about future product directions are a draw for Common, which now holds two conferences a year. The next is scheduled for the spring in Reno, Nev. The October Common reportedly drew about 3,000 users, most of them System/3 customers. A small number were users of the IBM 4300 and Series/1 systems.

In general, System/36 users are still working to absorb the impact of recent hardware improvements — changes that sped up the system and raised its performance level. They seemed more curious about recent changes than angry about system faults.

"It did seem that most users were satisfied with their 36s," said conference attendee George Weiss, an analyst with the Gartner Group, Inc. in Stamford, Conn. "Despite what the press says about the System/36 and its deficiencies, I don't think IBM is going to run away from it."

IBM recently said that it had shipped 110,000 System/36 units, making the System/36 the most widely installed machine, outpacing the previous record holder, the System/34 it replaced.

For many attendees, Common is a place to learn the details about system management: how to tune the system, manage it better or reconfigure it. The week-long meeting offered dozens of seminars, ranging from network management to communications software to disk-drive management.

Common also serves another purpose. It is one of the few opportunities during the year for IBM system designers and engineers to meet with hundreds of their customers face to face. The interchange allows customers to get insights into IBM product strategy, even as it gives IBM important feedback on how its systems are doing in the field.

If Common's user committees feel strongly enough about some user-suggested changes, they draft resolutions asking IBM to include them in the product line. IBM generally responds to these solutions at the following Common meeting with statements of acceptance, rejection or postponement.

Bozman is a Computerworld contributor based in Chicago

Genicom branches out, buys Centronics, gains Momentum

Separate deals valued at $120 million total

By Alan Alper

WAYNESBORO, Va. — In an effort to diversify its business holdings, printer maker Genicom Corp. agreed last week to acquire Momentum Technologies, Inc. — formally Mohawk Data Sciences Corp. — and Centronics Data Computer Corp. in separate stock and cash deals valued at about $120 million.

If concluded, the acquisitions will broaden Genicom's product line by adding Centronics' high-speed band printers and low-end dot matrix and laser printers and Momentum's IBM 3270 peripherals and other distributed data processing systems. Moreover, by acquiring Momentum, Genicom enters the extremely profitable maintenance business, which accounted for about half of Momentum's $165 million in revenue last year.

Under the terms of the proposed purchase of Momentum, Genicom would exchange 4.9 million newly issued shares of its common stock — valued at $45 million — for the Parsippany, N.J., firm. Momentum was formed earlier this year when New York venture capital firms J. H. Whitney & Co. and Welsh, Carson, Anderson & Stowe purchased the majority of Mohawk Data Sciences' assets for $81 million through a leveraged buyout.

Genicom is offering to acquire essentially all of Centronics' assets for $75 million in cash, a figure tied to the Hudson, N.H., firm's net book value and assumption of related liabilities. Genicom has engaged Drexel Burnham Lambert, Inc. to raise $75 million in subordinated debentures to finance the acquisition.

If concluded, the combination of the three firms would create the largest independent printer company, with approximately $500 million in revenue, according to Genicom's Chief Executive Officer Curtis Powell.

Don Ackerman, a general partner at J. H. Whitney and chairman of both Genicom and Momentum, said last week he hoped the combination of the firms would be completed during the next several months.

Acknowledging some overlap between Genicom and Centronics, Ackerman said management is just beginning to decide how to structure an organization combining all three companies.

Centronics, once the premier printer manufacturer in the industry, has fallen on hard times of late, as a phalanx of offshore competitors aggressively undercut its position in the marketplace.

"Centronics will stay a New York Stock Exchange company without a printer business," noted President Bob Stein. "We're now looking for an acquisition, but quite frankly, we haven't had time to look because we were too busy running a printer business. If the acquisition goes through, we will have time to look."

IBM restructures again, names two bosses to share Europe

By Clinton Wilder

ARMONK, N.Y. — In another executive move aimed at shoring up a weakening area of its business, IBM last week named Senior Vice-President C. Michael Armstrong co-leader of its European operations.

Although Armstrong will officially report to current IBM Europe President Kaspar V. Cassani, he will share the newly created IBM Europe chairman's office with Cassani. IBM recently attributed much of its disappointing third-quarter performance to slower growth in overseas markets, especially Europe.

"When an IBM executive is not doing well, he gets to share his office," said IBM analyst Bob Djurdjevic of Annex Research in Phoenix. "Europe has been lagging, so they are giving Cassani a push."

Djurdjevic also noted that the move could be a big career boost for Armstrong. "Foreign assignments like this are usually a good sign within IBM," the analyst said.

Replacing Armstrong as group executive of the Information Systems and Communications Group is Vice-President Terry R. Lautenbach, president of the Communications Products Division (CPD). The group includes CPD, the Entry Systems Division and Industry Systems Products. Lautenbach will report to Senior Vice-President Allen J. Krowe.

Vice-President Ellen M. Hancock will replace Lautenbach as president of CPD. She has been vice-president of telecommunications in CPD for a year.

NEWS

Open networks trigger user fears

From page 1

workable ONA protocols should be in place before the FCC removes the separate subsidiary requirement.

"This is the major network design issue over the next decade," added Henry D. Levine, attorney for the Committee of Corporate Telecommunications Users and a group of New York and California banks.

"First, users view themselves as potential buyers of ONA services. Second, there is an interrelationship between ONA design and the hardware needed to build networks," Levine said.

Levine explained that the regional holding companies may resist opening their networks to users. He noted that Southwestern Bell Corp. has asked the FCC to rule that users cannot buy ONA services.

With ONA, large corporations with multipoint networks will have the option of putting communications intelligence in distributed switching nodes located on customer premises, with only limited intelligence residing in the central office, Levine said. Consequently, he added, "The cost of internal data communications equipment could soar as the cost of buying services from the public switched network would drop."

To keep an eye on these issues, users group attorneys and communications managers attended the first meeting of the Open Network Architecture Forum, held by Bell Communications Research Corp. and the regional holding companies.

The key issue, said John Seazholtz, vice-president of engineering and operations at Bell Atlantic Network Services, Inc. in Arlington, Va., is, "What's the best way to offer to all providers of enhanced services connections to the network that are comparable both in cost and in quality with those that are available to the divested Bell operating companies for their enhanced services?"

Evelyn Eubank, network services planning manager at Southwestern Bell Telephone Co. in St. Louis, said the holding companies are aware that customers "need the highest degree of technical commonality for ONA that is feasible." It is not likely, however, that all seven regional holding companies will file identical ONA plans, so the goal is "similarity of interconnections," she said.

The FCC, particularly Chairman Mark S. Fowler, views ONA as the key requirement for further deregulation. Until ONA plans are approved in 1989 or 1990, the regional holding companies may be allowed to enter specific markets — without setting up separate subsidiaries — if they provide competitors a Comparably Efficient Interconnection to the local network.

NEWS

London Stock Exchange system overwhelmed on first run

Poised for profits, dealers left in dark

By John Lamb

LONDON — It had to be every DP professional's worst nightmare: The first live run, and the system falls flat on its face. That is what happened in London last Monday as the London Stock Exchange switched on its automated securities quotation system and became the first European exchange to embrace electronic trading and deregulation, in what has become known as the Big Bang.

Within an hour of opening for business at 7:30 a.m., the Stock Exchange Automated Quotations (SEAQ) system was out of action, and dealers had to return to pen and paper to complete their business. For more than half an hour, their terminals blank, dealers worked in the dark, relying on hasty telephone calls for the buying and selling prices the system was supposed to provide.

Stock exchange technicians pulled the plug on SEAQ after an existing videotex information system called Topic, which delivers SEAQ-generated data, was overwhelmed by inquiries.

"It was like the debut of the London Zoo," commented Sir Nicholas Goodison, chairman of the stock exchange.

Designed to handle a maximum of 200 inquiries per minute, Topic went down as users on more than 7,000 videotex terminals signed on to the new electronic share information. A spokeswoman for the exchange explained that Topic, which runs on nine Modcomp Systems minicomputers, normally handles 100 inquiries per minute.

Since dealers quoting securities on SEAQ are bound to honor the prices that are displayed on Topic, the exchange shut its systems down for half an hour in order to let subscribers cool off.

London's financial hot shots displayed a typically British stiff upper lip throughout the affair. "It's terribly British to always look for the faults in things," observed Goodison, who masterminded the deregulation of the stock exchange and the switch to electronic trading.

Will not happen again

The stock exchange was adamant that the problem would not happen again. "We have reprogrammed the system so that it cannot exceed 98% loading," the spokeswoman said just hours after the incident. At peak loads in the future, the spokeswoman continued, Topic would operate on a priority scheme with market makers (securities traders), taking precedent over outside investors who would have to wait for the pages they had requested.

The break-in service seemed to have little effect on trade, however. Despite the fact that dealers had to conduct early business either from the floor of the exchange or by telephoning for quotations, the stock exchange reported twice the normal number of transactions during the morning session.

The road to London's Big Bang began in 1983 when the stock exchange agreed with the government to end its system of fixed commissions for jobbers, or traders, and the stockbrokers who act for investors. Later, the exchange agreed to do away with the distinction between the two groups altogether and create a new style of trader called a "market maker," able to carry out both functions.

Not only did the stock exchange plan to sweep away its traditional demarcation lines, but also open up its doors to all comers. U.S. and Japanese financial conglomerates were allowed to join the exchange's "gentleman's club."

Automation of securities trading is a vital element in London's bid for a place in the international securities scene. The London Stock Exchange has now spent some $120 million on new systems and buildings to cater to digital trading.

Most of that money has been spent on SEAQ, a triple Digital Equipment Corp. VAX 8600 system, which receives the buy-and-sell prices of the 62 market makers connected to it and records their actual trades. The market makers interface to SEAQ either directly through standard stock exchange terminals or indirectly via in-house systems that provide their dealers with additional features and proprietary information.

Until now, it is these in-house systems, which are expected to provide market makers with their commercial edge, that have proved troublesome. Although market makers have spent the past year putting them together, some were still struggling to iron out the bugs days before the Big Bang.

"It's all been done so quickly and people have had so little experience that it is not surprising that things went wrong," said Alistair Hardy of the Framingham, Mass.-based market research firm International Data Corp. Some systems were put up in as little as six weeks.

Not surprisingly, market makers are edgy about SEAQ. After the last dress rehearsal 10 days before Big Bang, there were claims and counterclaims about the system's shortcomings.

The stock exchange's automation plans are by no means complete. SEAQ does not yet cater to automatic trading, although next year market makers wanting to buy or sell small quantities of securities will be able to do so via a system called the SEAQ Automatic Execution Facility. That system will match an order against the best quote currently available in SEAQ.

Lamb is a London-based correspondent for the European bureau of the CW Communications International News Service.

Bell Atlantic tests the micro software waters

By Douglas Barney

LAS VEGAS — In its first foray into the microcomputer software marketplace, Bell Atlantic Corp. will unveil at Comdex/Fall '86 its MVP Spreadsheet Plus, a $400 package aimed at financial modeling and spreadsheet users.

The package, which was originally developed with Gardner Computing, Inc. for Bell Atlantic's internal use, is aimed partly at the market Lotus Development Corp. now dominates.

According to Bell Atlantic, one of the product's unique aspects is its use of English-language commands. "We have a model with nine formulas in it which, if done in Lotus, would take more than a thousand formulas to set up — and these are done in plain English," said Dennis B. Limgenfelter, staff manager of micro software development at Bell Atlantic. "You can look at an English script with these English formulas in it and immediately have an intuitive grasp of how the model works."

The product, targeted at work groups within corporations, will initially be sold direct by Bell Atlantic. "This product is coming from an environment where people want to store a vast warehouse of data on mainframes, and access it to do financial modeling on the micro," Limgenfelter said.

A key aspect of the work group strategy is the ability to easily share data. "If you import data from one spreadsheet to another, the two people that have done the spreadsheets have to make sure that the cell locations match up when they do the import," Limgenfelter said. "In MVP, you can have two different departments build two totally independent spreadsheets. Then the data from one can be sent to the other department, and the package will logically sort the data, find all the label matchups and bring in the data wherever it matches up."

But Bell Atlantic paid a price for the sophisticated design of the product; it requires 1.5M bytes of hard

See BELL page 22

Comdex to feature 80386 tools

But lack of IBM support slows mart

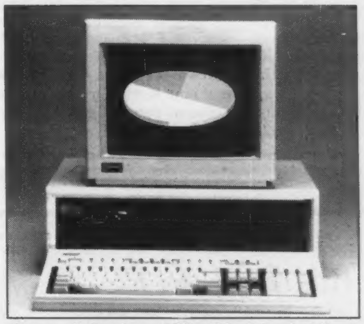
By David Bright

If IBM Personal Computer AT-class power is not enough to meet your microcomputing needs, then Comdex/Fall '86 in Las Vegas is the place to be next week. At least a dozen hardware vendors are planning to introduce or demonstrate Intel Corp. 80386-related products.

The powerful 32-bit 80386 microprocessor sparked a lot of interest when it was introduced 13 months ago, but so far only a handful of vendors have officially put 80386-based products on the market. Comdex/Fall will feature the most 80386-related activity yet.

But despite the increased activity, the fact that IBM has not yet entered the 80386 market seems to be holding some vendors back. Many vendors are known to have 80386-based systems waiting in the wings, but Compaq Computer Corp., with its $6,499 Deskpro 386, is the only major vendor yet to introduce such a machine.

Because of the uncertainty, only half the vendors expected to introduce 80386-based systems at the show will do so, says Dataquest, Inc. analyst Norm DeWitt.



Compaq's Deskpro 386 will be joined at Comdex by a dozen 80386-based products.

Among the products featured will be personal computer systems, network workstations, file servers and accelerator cards. System and workstation vendors planning to introduce systems or privately show systems to OEMs include Kaypro Corp., Convergent Technologies, Inc., Wyse Technology, Inc., Televideo Systems, Inc., Rexxon, Inc., Mitsui & Co. and Future International.

Board-level vendors preparing to demonstrate add-in cards include Applied Reasoning Corp., Quadram Corp., Orchid Technology, Inc., Definicon Systems, Inc. and American Computer & Peripheral, Inc. The majority of the products will not be available until early 1987.

A Kaypro spokeswoman says the prices of her company's two PCs will be "very competitive" with Compaq's system. Like the basic Deskpro 386, Kaypro's higher end model incorporates a 40M-byte hard disk drive and 1M byte of random-access memory (RAM). The basic system comes with 512K bytes of RAM. Both systems include 1.2M-byte floppy disk drives; a 60M-byte tape cartridge backup unit is optional.

See COMDEX page 18

Comdex to feature 80386-based tools

From page 17

Convergent is claiming its new product is important to the "future of network computing." The system is believed to be a small-footprint workstation that integrates Microsoft Corp. MS-DOS with a proprietary operating system.

Convergent has reportedly invested more than $10 milion in its 80386 development efforts.

Wyse will show 80386-based beta units that it has begun shipping to OEMs. A Wyse spokesman says the company is not planning to begin general distribution until the spring, when complementary software, high-resolution graphics cards and other hardware becomes available. He adds that IBM's intentions are not a factor in Wyse's decision to hold off.

> ***Many vendors are known to have 80386-based systems waiting in the wings, but the fact that IBM has not yet entered the market is holding some vendors back.***

Private presentation

Televideo will show its new system to OEM prospects in a hotel suite. Given the lack of appropriate 80386 software, it is too early to present the machine to the retail market, says systems product marketing director Ron Nakashima.

While many of the new systems are little more than souped-up IBM PC ATs, Rexxon is taking a different tact with its 80386 machine. Supporting up to 128 users, the system employs both an AT bus and a VME bus but was built to run Microsoft's Xenix System V and the Pick Systems Pick operating system.

The VME bus holds the microprocessor and works in conjunction with the AT bus, allowing the use of cards built for both buses, explains Vice-President Bob Love. Rexxon is not positioning the system as a personal computer product, but users have the option of purchasing their own copy of IBM PC-DOS to run on the system, he says.

London-based Future International is offering to customize its 80386-based system for retailers and value-added resellers. The company's XA-600 machine is reportedly targeted for computer-aided design, office, industrial automation, artificial intelligence and multiuser applications. For quantities of 5,000 or more, the system's price is said to be less than $2,500.

Added power

Most of the 80386-based add-in cards now appearing are designed to give added power to ATs for much less than the price of a new system. However, Applied Reasoning says its board runs in IBM Personal Computers, PC XTs or ATs, and Quadram has designed its product specifically for PC XTs.

Applied Reasoning President Dan Lickley stresses that his company's board is a prototype. Priced at approximately $1,995 with 1M byte of RAM, the board should be ready early in 1987, Lickley says. In comparison, Intel's recently announced Inboard 386/AT board retails for $1,995 with no memory and $2,495 with 1M byte of RAM.

While most vendors refer to such cards as "turbo" or "jet" boards, Quadram board products general manager Cynthia Ringo insists that the new Quad386 XT is not an accelerator card. Instead, she calls it a system replacement board. Quadram will be promoting the Quad386 XT as an inexpensive means of upgrading to a more powerful system while also gaining such benefits as on-board memory and the ability to run future software optimized for the 80386.

Ringo says the latter capability will set the card apart from 80286-based cards, which did not sell well. Scheduled for first-quarter 1987 shipments, the board retails for $1,495 with 1M byte of RAM. Ringo says that Quadram may bring out a similar board for the AT.

Claim AT compatibility

One reason for the 80286 accelerator boards' lack of success was compatibility problems. Nearly all vendors of the new crop of boards proclaim total AT compatibility, but one vendor says to be wary of such claims. Trevor Marshall, director of engineering at Definicon, says that the 80386 has inherent compatibility problems that could give his company's DSI-386 card — and possibly other companies' boards — trouble running copy-protected software and software that directly accesses the basic I/O subsystem.

The Definicon and American Computer & Peripheral boards will be priced at what is becoming a popular price point — about $1,995 for a 1M-byte configuration. In addition to the add-in board, scheduled for November shipments, American Computer & Peripheral will demonstrate a motherboard and system built around the 80386.

American Megatrends, Inc. will show its 80386-based AT-compatible motherboard to system developers. According to Executive Vice-President Pat Sarma, using a 32-bit bus, the board enables systems to run three times as fast as the AT.

TSL to demonstrate operating system for 80386-based PCs

At Comdex/Fall '86, The Software Link, Inc. (TSL) will demonstrate its multitasking, multiuser IBM PC-DOS-compatible operating system for Intel Corp. 80386-based machines. Offered in single-user, five-user or 25-user versions, the operating system will be available in February, according to the Atlanta-based company. The respective prices are $195, $595 and $995.

"We developed PC-MOS/386 so that PC users could seize the power of 386 technology while preserving their investment in DOS — an investment that includes software costs and the hidden costs of training and installation," said Gary Robertson, TSL's director of sales and marketing.

According to Robertson, TSL has "rewritten DOS from the ground up," keeping the same function calls and commands and adding extra features. "It runs circles around DOS," he claimed.

"We think it will have the greatest appeal to business and power users in general," Robertson said. "But a lot of people will move up to multiuser as they have the need."

The company plans to demonstrate the product at its booth on Computer Corp.'s Deskpro 386 system and possibly on an IBM Personal Computer AT with Intel's recently announced Inboard 386/AT add-in board.

Microsoft Corp. may have a multitasking version of its MS-DOS operating system available within the next year. But Robertson said he thinks Microsoft's competitive offering will help propel PC-MOS/386 because of the latter software's greater efficiency.

PC-MOS/386's features include support for record- and file-locking, intertask communication through the IBM Netbios protocol, print spooling, the Lotus/Intel/Microsoft Expanded Memory Specification, remote modem access, usage statistics, nested batch files, directory sorting and security at the user, file and directory levels.

Because PC-MOS/386 fully exploits all four of the 80386's modes, TSL expects software vendors to soon write 32-bit applications that will run simultaneously with existing MS-DOS applications, Robertson said.

— David Bright

Comdex to spotlight 80386 servers

By David Bright

Software running on Microsoft Corp.'s MS-DOS that takes advantage of the 80386 microprocessor's extended capabilities has yet to be developed, but several vendors hope to capitalize on the Intel Corp. 80386 chip's power by putting together systems that can function as file servers for other personal computers.

Vendors introducing such systems at Comdex/Fall '86 include Kaypro Corp. and Multitech Electronics, Inc. Core International, Inc. will show a 150M-byte hard disk drive that turns Intel 80286- and 80386-based personal computers into file servers.

Kaypro's file server is a high-end version of the two workstations it will be announcing at the show. Kaypro will offer three hard disk drives for the server, with capacities of 170M bytes, 280M bytes and 380M bytes. A Kaypro spokeswoman says the machine has been designed to run Novell, Inc.'s Advanced Netware 386 software when it becomes available.

While the market waits for IBM's 80386-based PC, Multitech marketing manager James Wong says Multitech's 1100 system, which is IBM Personal Computer AT-compatible, will most likely be used as a file server with the company's diskless PCs, also debuting at Comdex. At $3,995 with 1M byte of random-access memory and a 40M-byte hard disk drive, the system may be the lowest priced 80386-based machine on the market. An 80M-byte and a 130M-byte drive are optional.

With a monitor and a networking card, the Intel 8088- and 80286-based diskless PCs are priced at $1,059 and about $1,499, respectively.

With features like an average access time of 15 msec, an enhanced small device interface and proprietary software, Core International's new drive is the "world's fastest" personal computer drive, according to Marketing Director John Simonds. Carrying a three-year warranty, the drive is priced at $5,995; the drive's controller is $695. The drive enables a 6-MHz AT to outperform 80386-based systems, Simonds claims.

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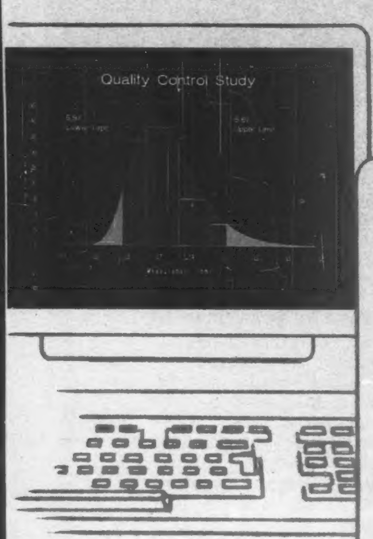

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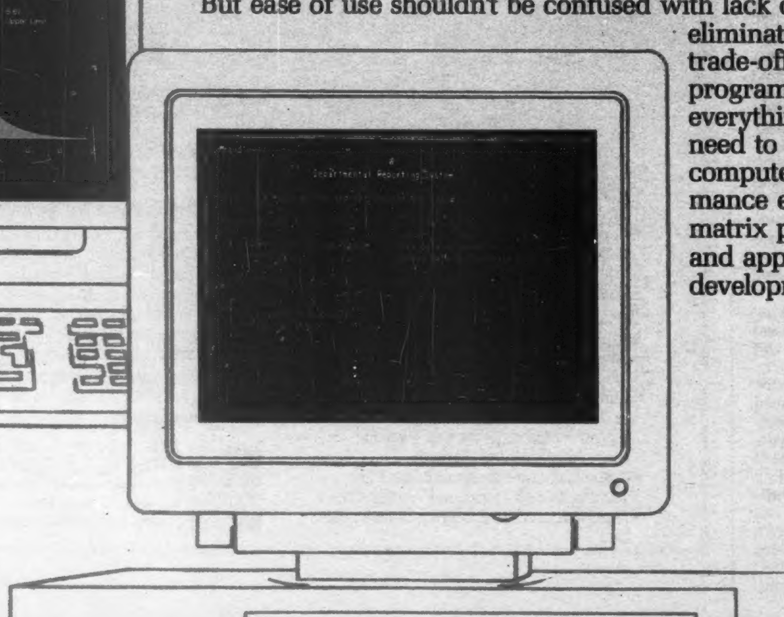

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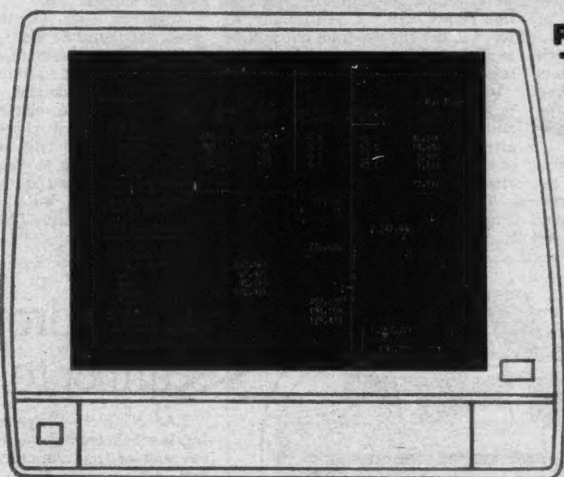

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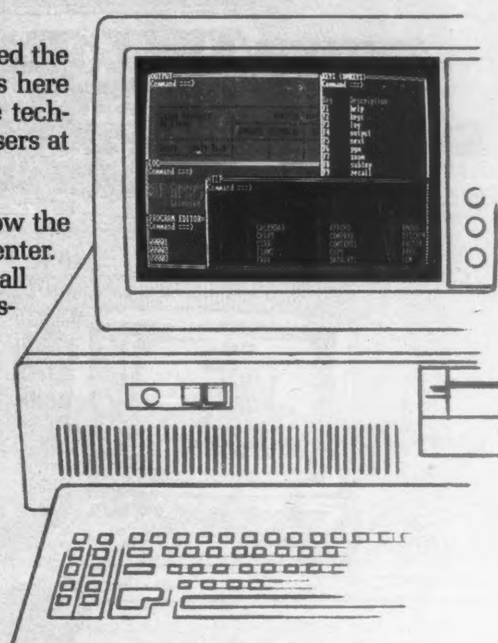

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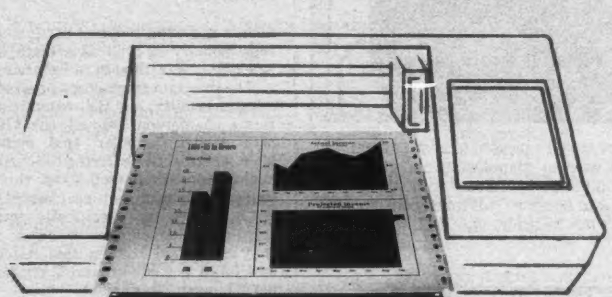

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Wordperfect to announce site license program at Comdex

Limits firms' liability for illegal copying

By Douglas Barney

LAS VEGAS — At Comdex/Fall '86, Wordperfect Corp. is expected to announce a site license program that provides corporations with limited liability for illegal copying of the software.

Under the program, corporations must commit to the purchase of at least 500 units, with previous purchases applying toward the fulfillment of the required volume.

Wordperfect is most noted for its popular Wordperfect word processing software.

A purchase of 500 units will cost $45,000; 1,000 units will cost $80,000; 2,000 will cost $140,000; 4,000 for $240,000; and 8,000 will cost $440,000, according to W. E. Peterson, executive vice-president of Wordperfect.

Under the unit designation, each copy of Wordperfect software counts as one unit, while the networking version counts as 1.4 units for the first user and 0.3 units for each additional network user.

Wordperfect for Digital Equipment Corp.'s VAX computers has already been announced and can also be applied toward the site license. "You can buy any product we offer for retail sale in any language we offer it on, on any machine we offer it on, under this same plan," Peterson said.

An unlimited site license, which would allow for unlimited duplication rights, will not be formally offered under the program but will be available on a negotiated basis, Peterson said.

Corporations that sign up for the program will receive free bug fixes and upgrades for the first year, and afterward they will have to pay 10% of the licensing fee for the same service.

The program will be sold through computer dealers as well as directly by Wordperfect.

Wordperfect will also be showing Databook, a microcomputer data base set for announcement early next year. The product will handle relationships among multiple files but will not support SQL.

In other news, Wordperfect last week announced Wordperfect Library for Data General Corp.'s AOS/VS computers. The product consists of a scheduler, calendar, phone message system and electronic mail. Wordperfect word processing and Mathplan already run on DG machines. According to Peterson, this offering is designed to compete with DG's own office automation software, Comprehensive Electronic Office.

Epson drop-in scanner to bow

LAS VEGAS — Epson America, Inc. is scheduled to announce an optical scanner that can scan both text and images and sell for less than $300. According to an Epson spokesman, the firm's scanner works in conjunction with Epson printers to provide a cost-effective means of scanning documents. The product will be marketed as an option for Epson printers. The product name was not available as of press time.

"There is nothing like it on the market. It is going to be for IBM PCs and compatibles and will work on Epson dot matrix printers that have color options," the spokesman said.

"It is a drop-in unit that you can drop in to the optional color motor. This scanner will fit into that same mechanism. You can scan any document you can fit in the printer," the spokesman added.

Bell Atlantic tests software waters

From page 17

disk, a full 640K bytes of random-access memory as well as a math coprocessor, according to Limgenfelter.

The program emphasizes programming capability, and Bell Atlantic offers a companion product, the $195 MVP Model Compiler, that makes MVP an attractive offering for corporate developers as well as for third-party developers, the firm claimed.

"It is set up specifically with third-party developers in mind, so they could take custom applications and build a shell around the product," Limgenfelter said.

An unlimited site license will be available for the product. "It will be based on the legal corporate entity and will include at-home privileges," Limgenfelter said.

"That price is set at $50,000 and allows the corporation to reproduce their own software for their employees and have an option to buy documentation from us for $80 per manual or reproduce it themselves or even customize it," Limgenfelter added.

NEWS

DB2 exceeds expectations: 1,000 licensed

By Mitch Betts

WASHINGTON, D.C. — Norris van den Berg, manager of IBM's Advanced Data Base Projects Office in San Jose, Calif., said last week that IBM has sold more than 1,000 DB2 licenses worldwide, a level of customer acceptance that exceeded IBM's expectations for the 18-month-old relational data base management system.

Van den Berg acknowledged that many buyers in 1985 merely experimented with DB2, but he asserted that 1986 has been a turning point as users start to commit themselves to using DB2 for major applications.

"Today, the product is accepted far greater than IBM had thought," van den Berg said at the IV League software users group meeting held in Washington, D.C. The IV League is comprised of users of software from Answer Systems, a division of Sterling Software, Inc.

David M. Saykally, president of Answer Systems in Canoga Park, Calif., said his firm will announce DB2 support for its line of data base software this fall, including the ability to convert IBM IMS applications to DB2 applications.

On the issue of whether users should turn to DB2 or IMS for data base management, IBM's van den Berg spelled out some guidelines to help puzzled users.

He said IMS is the product to choose for systems with high transaction rates and low cost-per-transaction rates, such as a network of automated teller machines. DB2 is the right product "if the goal is productivity, flexibility, ease-of-use and availability of application packages on top of it," van den Berg said.

"We see DB2 spreading to become a standard default DBMS . . . which will easily fulfill most operational data base requirements," he said.

Van den Berg said IBM's relational DBMS strategy has two major long-range objectives, which are the following:

- Provide a standard SQL interface on every strategic processor that IBM makes. DB2 follows the SQL standard with a few deviations, and IBM will work to make it 100% compliant.
- Provide connectivity across the various low- and high-end SQL systems, which requires a set of communications protocols.

For hierarchical DBMS, IBM's long-range strategy is to enhance IMS so it can exploit the power of the next generation of processors for the largest installations, van den Berg said. He said IBM expects to see networks in excess of 150,000 terminals and transaction rates at 4,000 transactions per second for certain applications.

Van den Berg said IBM will continue to have two different DBMS lines for a long time, and both will be maintained and enhanced for future use. "It will mean difficulties for a time for people who are trying to use both, but they each satisfy a set of requirements that the other can't satisfy," he said.

N.Y. creates info network

Nysernet will link labs with universities

By Alan Alper

NEW YORK — A high-speed data communications network enabling researchers at educational institutions and laboratories in New York state to share informational resources will be launched early next year through a joint state and local telephone company project.

The network, called New York State Education and Research Network (Nysernet), is being jointly developed and operated by New York Telephone Co. and Rochester Telephone. A New York-funded, not-for-profit corporation, Nysernet, Inc., has been established to coordinate university and research lab involvement and to seek the participation of state industrial firms.

Nysernet will initially connect computers at 14 universities and the Brookhaven National Laboratory. The network will begin a two-year trial run beginning in January, officials said.

Nysernet will use packet switching technology to transmit data over public telephone lines at 56K bit/sec. Based on actual usage and economic considerations, Nysernet may be upgraded to operate at 1.54M bit/sec. sometime next year, officials noted.

The network will adhere to the Transmission Control Protocol/Internet Protocol (TCP/IP), New York Telephone officials said. The TCP/IP protocol was chosen because it is the standard used by most research institutions and the U.S. Department of Defense and is compatible with most architectures and operating systems in existence, officials added.

New York Telephone and Rochester Telephone will operate six regional networks within their local access and transport areas (LATA).

New York Telephone will operate five of the regional networks, providing services to Nysernet campuses within its operating territory, while Rochester Telephone will operate the sixth regional network. RCI Corp., Rochester Telephone's long distance subsidiary, will provide transmission across New York between LATAs.

Switching equipment, supplied by Proteon, Inc., is currently being installed at each participating institution. Some of the universities involved include the State University of New York at Albany, Clarkson College of Technology and Columbia University.

Nysernet has received $400,000 in funding from the New York State Urban Development Corp. The corporation has received commitments from IBM and Eastman Kodak Co. and hopes to enlist the involvement of Xerox Corp., General Electric Co., Grumman Corp. and Corning Glass Works, Inc.

NEWS

WASHINGTON UPDATE
Mitch Betts

Revised Treasury order covers government EFT

The U.S. Department of the Treasury, responding to complaints from the banking industry, has revised its security directive for electronic funds tranfers (EFT) so that it covers only the federal government.

In 1984, the department ordered all financial institutions to comply with the EFT message authentication standard X9.9 by June 1988 or be liable for misdirected wire transfers. The directive reportedly shocked the American Bankers Association and prompted negotiations to tone it down.

The Treasury Department reportedly backed down because it lacks legal authority to impose the standard on the private sector.

The revised policy states that the authentication standard will apply to "federal systems which originate, transmit, relay, receive or process federal government EFT transactions."

GSA requests bids for D.C. area telecom system

The U.S. General Services Administration (GSA) has issued a request for bids to replace the federal government's Washington, D.C., area telecommunications system with an all-digital voice/data network.

The proposed Washington Interagency Telecommunications System (WITS) will serve more than 100,000 government customers in 54 buildings and is expected to be a 10-year, $500 million contract.

The metropolitan network will connect to the government's forthcoming long-distance digital network, called the Federal Telecommunications System 2000.

GSA Administrator Terence C. Golden said the WITS network will cut costs by greatly increasing data transmission speeds, connecting local-area networks of microcomputers via digital circuits, providing teleconferencing service and allowing agencies to easily change telephone numbers.

IBM plans 9370 version for military applications

IBM's Federal Systems Division in Oswego, N.Y., is developing a military version of the recently announced IBM 9370 Information System mid-range processor that may be deployed as a portable analyzer of intelligence data.

The S/MIL-370, using the 9375 Model 60 commercial processor, has been engineered to meet Pentagon requirements for use in harsh environments, such as in vehicles, shelters and in the field, IBM officials said.

Military applications include portable data processong, aircraft mission planning and deployable intelligence data handling, IBM said.

IBM's strategy of adapting commercial technology to meet military needs is consistent with the Pentagon's goal of using off-the-shelf technology to cut costs and get technology into operation faster.

Library of Congress issues optical storage guidelines

The Library of Congress, the world's largest library, has issued what observers are calling landmark guidelines for handling copyright and competition issues concerning optical disk storage of reference materials.

First, the library agreed not to put copyright-protected materials into optical storage without getting permission from the copyright holders. For the pilot project now under way, the library has obtained permission from about 70 publishers.

Second, the library agreed to limit the provision of service based on its optical media to the Capitol Hill area. Consequently, private companies offering similar services elsewhere will not face competition from Library of Congress services.

The Information Industry Association (IIA), which has members who put reference materials on optical disks for sale to libraries, praised the Library of Congress for establishing the guidelines.

"These guidelines will serve as an excellent model for other agencies facing these issues," said IIA President Paul Zurkowski.

CBEMA bestows awards on allies in Congress

The Computer and Business Equipment Manufacturers Association (CBEMA) has announced the 17 recipients of its new Public Policy Awards, given to industry allies in the U.S. Congress.

The awards, which will be presented annually, recognize government officials who support public policies that promote high technology, according to a CBEMA spokeswoman. Most of the awards went to members of Congress who supported CBEMA's positions on tax, trade and procurement issues.

Recipients from the U.S. Senate were Sens. Max Baucus (D-Mont.), John H. Chafee (R-R.I.), John C. Danforth (R-Mo.), Christopher J. Dodd (D-Conn.), Carl Levin (D-Mich.), George J. Mitchell (D-Maine), Bob Packwood (R-Ore.) and Dan Quayle (R-Ind.).

Recipients from the House were Reps. Don Bonker (D-Wash.), Bill Frenzel (R-Minn.), Sam Gibbons (D-Fla.), Frank Horton (R-N.Y.), Robert T. Matsui (D-Calif.), Norman Y. Mineta (D-Calif.), J. J. Pickle (D-Tex.), John M. Spratt Jr. (D-S.C.) and Ed Zschau (R-Calif.).

VIEWPOINT

EDITORIAL

Back to the future

Celebrations of landmark dates in computing often seem strangely out of place, since this is a technology and industry of the future, not the past. Change is the seminal thread that characterizes the history of computing — explosive and ubiquitous change.

No sooner do we digest the impact of one quantum leap forward than another emerges to dwarf its predecessor. Machines run faster and better and cheaper. Processing stretches farther and farther from the data hub, as information becomes gold to all varieties of professionals.

In this heady atmosphere of what Alvin Toffler dubbed The Third Wave, it can be enlightening to stop and assess where we are. Thus, this special issue of *Computerworld* marks both the 40th anniversary of Eniac, the acknowledged first large-scale electronic digital computer, and our own 1000th issue.

Presper Eckert, John Mauchly and their brilliant team of engineers at the Moore School of the University of Pennsylvania could hardly have imagined what they had wrought in 1946 when they unveiled their wondrous room-size machine. The implications, however, turned out to be enormous.

Could Bell's telephone or Edison's light bulb be any more significant to the flourishing of civilization than the Electronic Numerical Integrator and Computer? To answer, one has only to try to imagine today's society without computers.

The computer changes what it touches. Medicine, finance, business, education, entertainment and social science have become virtually unrecognizable disciplines in the 40 years since Eniac debuted. Each field has spawned unique and vast dependencies on the computer, inextricably intertwining the technology with the science.

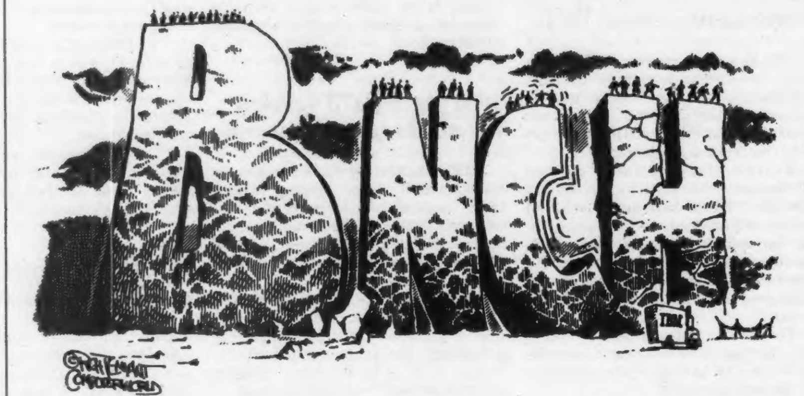
Very little of our daily lives remains untouched by computerization, and despite the dire and depressing Orwellian warnings, computers have served more to enhance and enlighten than to suppress.

Perhaps no one has had the opportunity to witness this change more closely than the data processing professionals whom we have served during nearly two decades. For 1,000 weeks, *Computerworld* has chronicled the unparalleled growth, technological advancement and industrial trends that have shaped the computer age.

We reported on and helped map the transformation from DP/MIS to information systems professional, and we noted with pride the dramatic shift in the mind of corporate America toward our readers, elevating them from a back-room service organization to a vital and strategic partner in steering the corporate ship.

So, in a world where there is hardly a moment to stop and consider the future, we encourage you to join us in celebrating these anniversaries of achievement. Much can be learned from viewing, with the benefit of hindsight, the dizzying pace of development in computers and the effects on business and society.

One can only guess, with science fiction-like conjecture, what this industry will look like in 2005, when we celebrate our 2,000th issue and are planning the 60th anniversary celebration of the information age.



LETTERS TO THE EDITOR

SQL: Taking the long way around

I read Stephen Gerrard's article on Structured Query Language [CW, Sept.22] and found his SQL solution to "find supplier names for suppliers of red parts" a little like flying from San Francisco to Los Angeles by way of Anchorage — it gets you there, but it's a long way around.

Those of us who are less mathematically inclined would probably shun the double subqueries in favor of a simple join of the three tables. This observation should not detract from the points made in Mr. Gerrard's article. I am often frustrated by missing functions that seem to be intuitively obvious. But the technology is relatively new and there's lots of room for growth.

We look to Applied Data Research, Inc. and IBM and others in the industry to satisfy our requirements.

Gerard J. Carney
Carney Associates
Mountain View, Calif.

The obsolescence of Grosch's Law

A necessary, but not sufficient, condition for the accepted arrival of yet another era of computing is the appearance of letters and articles implying Grosch's Law — that the cost of computer systems increases at a rate equivalent to the square root of their power — is obsolete.

Twenty years ago, it was minicomputers: "Get your PDP8s here, folks, and save a fortune." Fifteen years ago, it was time-sharing: "Sign with Tymeshare, folks, and save another fortune." Ten years ago, it was microprocessors: "Put a personal computer on every desk, folks, and save a third fortune."

Another era may indeed be dawning — supercomputers. This time I thought my bedraggled old law was safe, since if supercomputers fly, it will be because fast is cheap (as I have been saying since 1950).

Not so! In the article, "Boeing plots to furnish users with supercomputing capability" [CW, Sept. 29], Boeing Computer Services Co. virtually says: "Get your minisupers here, folks, and save that last fortune you've been hanging on to." I couldn't believe it!

Here is an outfit that actually uses Cray computers and knows how powerful and rewarding they are. And they are claiming that slower machines are better?

Well, as I said when I started, the CW article makes it official. The supercomputer era is here. You can tell by the customary denigration of my poor brainchild.

Herb Grosch
Mies, Switzerland

Hot DP careers versus cold facts

Recent local TV ads and articles in *Computerworld* depict a shortage of qualified DP personnel creating a backlog of demand for DP people and making this field a super-hot career opportunity. Even the U.S. Labor Department stresses DP as one of the best career prospects through the 1990s.

This message is certainly misleading because it hides a number of facts. One is that a shortage of personnel is often created by DP managers themselves as they insist on extreme technical requirements in filling their jobs and show an unwillingness to moderate these demands. The search continues until the applicant that closest fits the technical profile is found, with the search time far exceeding that expected.

Managers have reacted by shifting the burden of locating such technical experts to outside DP consulting firms who then will "rent" staff under contract. Although these consulting firms insist they handle all types of business, 80% is tied to programming contracts. Those who work for the consulting companies do so as programmers.

When managers complain of a shortage of qualified data processing people, they send out a message saying there is a real lack of such people and, in turn, give the impression that the doors are wide open to DP opportunities. That is not so!

About four months ago, I contacted a Denver firm regarding a systems development manager ad. I learned from the hiring manager that he had received 500 replies from all parts of the country for this one position, that indeed there was no shortage of qualified personnel for management level jobs, but rather a surplus of them.

The opportunities lie within the experience range of one to five years for a programmer and the bastardized position of analyst/programmer. The new graduates are told to get at least one year's experience and then return. Now the applicants have to solve the problem of where to get that year's experience.

If the artificially high technical requirements are overcome and the first year's experience

See **HOT** page 31

VIEWPOINT

Big Blue: Down for the count but not out

By AMY D. WOHL

IBM-bashing is a popular sport these days. When anything that big and that successful for that long shows even temporary feet of clay, joy in certain quarters is perhaps inevitable.

On the other hand, reports of IBM's death are, to paraphrase Mark Twain, greatly exaggerated. So are rumors that IBM is about to disappear from any of its significant markets. Sometimes such reports are based on a genuine misunderstanding of how a company as large as IBM operates. More often, they simply represent wishful thinking on the part of eager, and frequently naive, competitors.

Guessing wrong

This is not to say that IBM doesn't sometimes guess things completely wrong. IBM guessed wrong about minicomputers, permitting DEC to start and succeed in a virtually new industry. IBM also guessed wrong about electronic typewriters. It thought they were a continuation of the electric typewriter market in which IBM enjoyed a virtual monopoly and IBM sales representatives had no reason or need to sell anything — they just took orders. Panasonic Co., Xerox Corp. and a host of others were the beneficiaries here.

One could be really cruel and mention the middle period of the word processing market, when IBM missed the point entirely and Wang (and others) chewed a large hole in IBM's hide. However, the point is that IBM has been right more than wrong.

Sometimes this seems to occur because of good planning. More often it has been a combination of good timing, lots of resources and a bit of good luck.

IBM's contributions

Think of the IBM Personal Computer. IBM wasn't first in the market. It probably doesn't and never did have the best product. (If that means technical superiority, best price or whatever — you decide.) But it brought IBM's unique contributions to the table:

- It validated the product for business users. That is, IBM's entry signaled to the entire business community that personal computers were OK. That serves to further not only IBM's interests, but the interests of all of its competitors.
- With its enormous installed base of customers and ability to attract additional customers to any market in which it chose to compete, IBM could address a very large market. Therefore, it could build products and compete very effectively, based on an economics of scale available to only a very few vendors.
- It provided an assurance of market size (and supported that available market with openly published information about its PC products) that enticed third-party hardware and software developers, in largely unanticipated numbers, to build products for the IBM PC environment and substantially expand that environment.
- It provided a large, very stable window in which competitors could succeed by offering IBM-like products at better prices or by enhancing the basic IBM product model while maintaining the IBM compatibility that is the basis for this market activity.

The Giant Killers — those who are constantly seeing fatal flaws when what is happening are course corrections — assume that IBM doesn't know its strengths or can't apply

See BIG page 30

Wohl is president of Wohl Associates in Bala-Cynwyd, Pa., and editor of "The Wohl Report on End-User Computing" newsletter.

The blessings of a baffling blizzard of buzzwords

By DAVID H. AHL

There was a time when bureaucrats and sociologists were the only "in" groups determined not to be simple but to use acronyms and complex language where a few stalwart English words would serve equally well. Other "in" groups, convinced these people were on to something good, but not quite sure what it was, started to produce their own jargon.

As the trend spread, a small band of old-fashioned language mavens railed against the use of such jargon, occasionally using such harsh phrases as "murdering the English language" and "ideas lost in the maze of complexity."

The virtues of jargon

But they missed the point. Jargon is basically good. It is descriptive, compact, colorful and versatile. And on occasion, it lends an air of respectability — even unapproachability — to the user. Let's examine some of the virtues of jargon in more depth.

Jargon is concise. Consider these headlines from recent issues of various computer publications: "DDE protocol integrates Windows applications," "Honeywell ties OA, DP, other systems," "Customs Service slaps duties on Japan OTP EPROMs" and "HP RISC designer exists for startup." These headlines are clear and concise. Everyone in the business knows what they mean. How much better that is than having to explain that DDE means dynamic data exchange, OA is office automation and DP data processing. And surely OTP EPROMs is better than saying one-time programmable erasable programmable read-only memory chips. (What?)

Jargon separates those in the know from outsiders. Consider these two headlines: "Tool targets CICS crashes" and "Linear Tech gets second DESC approval."

Okay, I admit it, I don't know what CICS and DESC are. I was lured into reading an 800-word article and a 500-word article and was still in the dark. Then I realized I was not meant to know what these things are. People in the know don't think twice about terms like these; they know what they mean and possibly rest a bit more easily knowing others don't.

Admitting ignorance

Several years ago, I sat through an hour-long lecture given by a top executive from Hewlett-Packard Co. about the wonders of RISC. Not once in the lecture was RISC defined. After the lecture, I asked a perfect stranger what it was — I was certainly not going to admit my ignorance to someone who knew me — and he laughingly told me the definition. This is not an approved way to discover the meaning of jargon, but I was desperate.

Jargon gives credibility to the profession. Imagine how you would feel about a stockbroker who did not talk about P/E, RDI, historic multiples, EPS, yield support levels and Ginnie Maes. You would not respect him and might regard him as an ordinary person rather than a knowledgeable investment counselor. Likewise, peppering your conversation and writing with terms like PC, MIS, LAN, token-ring and VAR will easily convince outsiders that because they don't understand what you're talking about, you must be a genuine computing professional.

Special situations

Jargon can meet the needs of special situations. Say a salesman is extolling the virtues of a wonderful new data base. You reply, seemingly innocently, "Well, dollars and sense is no paradox, but sometimes I prefer to consult my guru." The salesman thinks to himself, "I've got this guy; he wants a sensible approach. I just have to show him that I can be his guru."

Imagine your triumph when you later explain to this pitiful excuse of a salesman that he should have known all along that you meant that Monogram Corp.'s Dollars and Sense package is not as powerful as Ansa Software Co.'s Paradox data base, but that for certain investment decisions, the Guru package from Micro Data Base Systems, Inc. is even better.

So next time you're tempted to heed the admonishments of William Safire, Edwin Newman or some other language maven who says that jargon is simply a blizzard of buzzwords burying thought, remember the virtues of jargon — its conciseness, credibility, versatility, importance to the profession and, most important, its ability to baffle.

Ahl founded Creative Computing Magazine *and is the author of more than 20 books on recreational, educational and professional computer applications.*

The liabilities of not using computers

By HOWARD G. ZAHAROFF

READER'S PLATFORM

People in the computer industry will not be pleased to hear about another computer-related liability. That's because the ones that spring to mind cost them money: misrepresentation, strict product liability, breach of warranty, negligence, even computer malpractice. (The last isn't established yet, but recent cases indicate it may be coming soon.)

But, what about the notion that one might be liable for failing to use a computer? Can the law require you to spend money on a computer? Can it require you to become familiar with computer technology so that you can make an informed choice? Could the law be so intrusive?

The answer is yes and no. Typically, the law will not force an individual in his private capacity to become expert in technical areas, spend substantial time selecting from available services or goods or spend money on luxuries.

Still, the law will occasionally require a private citizen to make certain expenditures or spend time in a certain way. For example, one must file tax returns, make sure that one's land is not unreasonably dangerous to children or passersby and keep one's car in safe condition.

Who's responsible

However, in general, I am not thinking of individuals in their private capacities, but of businesses, businessmen and professionals. For example, I can imagine a hospital, clinic or doctor being held liable if a patient was injured as a result of failure to use a proven diagnostic expert system. I can envision a law firm being found liable for failing to discover a critical precedent it would have discovered had it used cost-justified, computer-based research tools such as Lexis or Westlaw. And I can picture an architect, builder or auto manufacturer held liable for damage or injury caused by a defectively designed product when use of available computer tools would have prevented the error.

Indeed, there are legal precedents, both old and new, for this type of liability. A classic example is *T. J. Hooper*, a 1932 federal case involving barges of coal lost off the New Jersey coast in an easterly gale while being towed by two tugs, the *Montrose* and the *Hooper*. The tugs were found unseaworthy "because they did not carry radio receiving sets by which they could have seasonably got warnings of a change in the

See LIABILITIES page 31

Zaharoff is an attorney with the Boston firm of Brown, Rudnick, Freed & Gesmer.

VIEWPOINT

Big Blue: Down but not out

From page 27

those strengths to new problems. The IBM Watchers — those of us who have learned to respect the Big Blue giant, nevertheless knowing its faults — believe IBM may veer off course from time to time but that size, resources and customer loyalty count. Those smart people, perhaps IBM's biggest resource, will eventually recover their senses and put IBM back on the right path.

IBM tells us that its announcements in October are an example of this kind of mid-course correction. While the giant killers murmur that a 9370 is not a VAX killer, IBM remembers that much of its customer base is elsewhere, in very large companies where the major computing resource is not how many mainframes or million instructions per second the company has, but how many computer programmers and what kinds of skills they have.

In that environment, IBM is largely right. Expanding the compatible IBM product line to permit big customers to build smaller applications within the same computing environment is almost bound to be appealing. And in any case (giant killer commentators, take note) DEC hasn't been very successful yet in selling big VAXs and Vaxclusters as replacements for conventional, 370-compatible technology. That is partly due to a temporary saturation of product in this part of the market, making it hard for everybody to sell and partly due to 370-compatible operating systems and applications software issues.

In fact, it is scalable, compatible operating systems and lots of third-party applications software that has made DEC so successful in competing against IBM for the mid-range market. There the customer may seek turnkey solutions and may not necessarily be so concerned with compatibility, with mainframe operating systems or with the ability to write their own software.

Of course, the question lies in when we will see the impact from these particular mid-course corrections that shore up the weak, mid-range processor part of IBM's product line. I believe that the lag cycles, and, therefore, the continuing short-term problems in revenue, may be longer than IBM thinks.

> ”
> ***The 80386-based next-generation PC could permit IBM to maintain the high growth rates it's looking for.***

Bringing up new applications within the 370 big-customer market takes time. I'd guess the real impact of the 9370 product line, based on these activities, won't hit until 1988. This leaves Big Blue with a potentially sluggish 1987, waiting for the 9370 to take off and liable to suffer some potentially revenue-negative effects due to better price/performance for the new products and IBM's aggressive Graduated Software Pricing Program.

But this ignores the big IBM announcement we're all waiting for — the 80386-based next-generation PC. It is the combination of IBM's new mid-range processors, the potential software for these processors (as yet virtually unannounced) and new, more powerful workstations that could permit IBM to maintain the high growth rates it's looking for.

Watch out, Giant Killers. IBM may be bloodied by its previous poor guesses and their impact on 1986 revenue. But that doesn't mean Big Blue is out of the race. We expect lots more surprises from IBM in the next 12 months. And we expect it to leave plenty of room in the marketplace for existing and new competitors to flourish.

VIEWPOINT

Liabilities of not using computers

From page 27

weather which should have caused them to seek shelter . . ."

The court reasoned: "An adequate receiving set suitable for a coast-wise tug can now be got at small cost and is reasonably reliable if kept up; obviously it is a source of great protection to their tows . . .

"Is it then a final answer that the business had not generally adopted receiving sets?" No, said the court, reasoning that when devices reasonably necessary for safety are readily available at a reasonable cost, it is negligent not to use them. Moreover, this can be so even if there is no custom in the "calling" to use them.

Court-applied principles

Lest you conclude that it will be many years before computers will be placed in the same category as radio receivers, let me describe a recent case in which a court applied the principles underlying *T. G. Hooper* to computer technology.

Swiss Air Transport Co. v. *Benn* was decided initially in 1983 by the New York City Civil Court. Swiss Air sued Gale Benn for $2,000, the difference between the amount Swiss Air was paid for two Geneva-to-Basel airline tickets used by Benn's son and the actual value of the tickets. These tickets were purchased from a New York travel agency for $200, then the names and destinations were altered and the tickets were resold to Benn, who claimed he paid $750 per ticket. Prior to the flight, Benn brought the tickets to Swiss Air's New York office to confirm the reservations.

Swiss Air claimed that its ticketing procedures did not permit the discovery of alterations until after a flight. The court, in deciding which of two parties would bear the loss caused by the ticket alterations, agreed with Benn that the airline should be "equitably estopped" from suing him because it had honored his tickets and had not detected the problem until months after the trip.

The court reasoned, "Plaintiff Swiss Air could have prevented the passengers from using altered tickets by maintaining a system capable of confirming which passengers are scheduled for a particular flight. In light of the advanced computer technology available today, this is not an unreasonable burden to place on the plaintiff."

Unreasonable failure to use a computer

In short, the court found that an airline "owes a duty to use reasonable precautions when inspecting and confirming a passenger's flight ticket," and that Swiss Air did not meet that duty because it failed unreasonably to use a computer system capable of detecting errors.

Before members of the computer industry applaud, they should know that in 1985 the New York Supreme Court, Appellate Term, reversed the lower court's decision.

This court used two lines of reasoning. First, much of Benn's testimony was found unbelievable and inconsistent: He didn't look like an innocent party. Second was the fact that "[the record] is absolutely devoid of testimony, expert or otherwise, suggesting that the procedure and equipment utilized . . . in issuing and accepting the controverted tickets deviated from accepted practice in the airline industry."

Two points stand out in this decision. First, unlike the court in *T. J. Hooper*, this court believed that the "accepted practice in the airline industry" was the standard by which to judge Swiss Air innocent or at fault. Second, the court never denied that a business might be liable for failing to use adequate procedures, including a computer system.

In short, on the basis of legal principles that have been with us for many years, a failure to use available useful computer systems could give rise to liability. From the above, one can see that an important legal question will be whether the common practice of the business or profession involved will be a prerequisite to liability or only a factor to be considered.

Yet, regardless of the ultimate resolution of that issue, there can be no doubt that within any business or profession, as the usefulness or need of available computer technologies increases, as the cost of these technologies drop and as more practitioners adopt them, computers shift from luxuries, or matters of choice, to legal necessities.

Hot DP careers vs. cold facts

From page 26

gained, then the new employee can enjoy about five years of worry-free job efforts. Then comes a period from the mid-30s through the early 40s and beyond that is a danger period, when the older, experienced employees are in danger of being terminated, and those over 40 find the doors to any position other than programmer tightly closed. Age discrimination in hiring begins in the late 30s and increases in severity as an applicant gets older.

Due to such practices, "career" as it relates to DP is limited to programming tasks. For applicants who think DP will be a fast-track field for rise to management positions, bitter disappointments are bound to develop as they learn the hard way that employment in this field often means employment as programmers.

John Callahan
Arlington, Texas

SYSTEMS & PERIPHERALS

HARD TALK
James Connolly

Sell substance, not buzzwords

The buzzword of the 1970s — distributed processing, also known as departmental processing — is back in the computer industry's everyday vocabulary. It has been popping up in business publications, product announcements and management seminars.

The financial success of Digital Equipment Corp., the financial woes of IBM and IBM's own announcements of the past six months — the System/36 and System/38 additions, the emphasis on networking and the 9370 introduction — have driven speculation and flat-out predictions that smaller systems are the way to go.

Of course, the skeptic might note that distributed processing was also the way to go eight years ago when IBM took the wraps off the 8100 series, which is still slipping toward one of the industry's more painful deaths. And even DEC was successful, if not Wall Street's darling, for its first two decades of promoting its minicomputers-over-mainframes solution.

But it is obvious that some continued shift toward distributed processing will continue for several years and that success awaits the user and vendor companies that can best implement distributed processing solutions.

Unfortunately for some companies in both the user and vendor communities, simply making commitments to distributed solutions does not spell success.

Some of the lucky ones, at least on the vendor side, have been DEC and

See SELL page 39

Connolly is Computerworld's *senior editor, systems & peripherals.*

IBM restricts 9335 delivery

Newsletter hints access time setbacks responsible

By James Connolly

Amid speculation that access times have fallen short of what was promised, IBM has restricted the number of 9335 disk drives that it will ship to individual customers.

IBM officials deny there are any performance problems and claim that the restrictions — for example, a customer with one IBM System/38 processor can receive only one 9335 — are due to unexpectedly high demand for the 855M-byte drive, which was announced in June.

But reports persist that IBM either stopped or limited shipments after discovering that access times failed to meet the promised 18-msec average because of microcode problems.

The performance problems were cited in a recent newsletter published by computer dealer UC America, Inc. and were raised during the meeting of Common, an IBM users group, two weeks ago.

Attendees at the Dallas Common meeting said officials from IBM's Systems Products Division in Rochester, Minn., assured them that the 9335s are performing well but added that there may be some problems in the way that the disk systems connect to hosts.

"What we found is that IBM made the first wave of shipments of the 9335 and actually may have found them to be slower than the 3370," said UC America President Charles G. Hanna. He said he was continuing to investigate the performance reports last week.

When introduced June 16 for August deliveries, the 9335 was offered for use with the System/38. However, since that time, IBM has introduced the 9370 midrange system, which also supports the 9335.

When asked about reports of problems, a spokesman for IBM's Information Systems Group in Rye Brook, N.Y., said that there are no performance problems and that the 9335 is meeting its specifications. He initially reported that shipments had been postponed for six months because of the unexpected demand. However, the spokesman later corrected that to state that the product was shipped on time and was still being shipped. He then reported that the six-month time period relates to the per-customer limit.

As an interim measure, IBM is continuing a special installation program announced with the 9335's introduction. Under that program, customers who order 9335s reportedly can receive the older 3370 free of charge for use until the 9335 is delivered.

INSIDE

NEW THIS WEEK

- Datachecker offers 32-bit-based point-of-sale systems

■ For more on this and other new products, see pp. 115-143.

DATA VIEW

On the rise

Third-party lessors take a greater market share

Method of Acquisition	1984	1985	1986
Purchase	51%	56%	54%
Rent or lease from manufacturer	24%	14%	14%
Lease from third party	25%	30%	32%

Information based on Datapro Research Corp. annual surveys of mainframe users.

Slide seen in growth of fixed disk market

By Eddy Goldberg

LOS ALTOS, Calif. — During 1986, worldwide revenue for all types of rigid magnetic disk drives is expected to rise only 9.7% over 1985 levels to $15 billion, marking the first time in the 1980s that annual revenue growth for this market is expected to fall below 15%.

However, a resurgence to a 19.6% annual growth rate in the 1987 to 1989 period is predicted in the recently released *1986 Disk/Trend Report*, published by Los Al-

See SLIDE page 41

INSTANT ANALYSIS

"Software is the heart of our business. Software is what we offer, and the hardware is something that goes with the software."

— **Digital Equipment Corp. Chairman and CEO Kenneth Olsen**

Mainframe-to-mini switch lights fire under gas firm's MIS

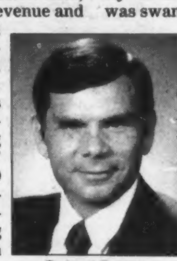
'Glass house' grows cold as VP pilots switch

By Donna Raimondi

A cost-cutting mandate from top management and a "strong suggestion" to reduce its MIS head count led a Texas natural gas company to abandon its traditional IBM mainframe installation for a network of minicomputers.

In addition to throwing out much of its complex centralized mainframe environment, El Paso Natural Gas Co. eliminated $5.5 million in operating costs and 33% of its MIS work force over a period of four years. The company also sold a $6 million glass house it no longer needs, according to Robert Evans, vice-president of planning and information systems.

"You can do more with less," Evans said. The gas transmission firm, with $3.7 billion in 1985 revenue and 4,000 employees, faced dollar cutbacks and increasing end-user demand toward the end of 1982. "We evaluated the status and direction of our situation and saw competing demands on resources," Evans told more than 100 attendees during a presentation at the annual International Society of Wang Users, held recently in Boston.



Robert Evans

The gas company wanted to put more users on-line, update its application software and add functions for strategic business benefits — all of which required new tools and more staff. "The complexity of the mainframe environment was swamping us," Evans recounted.

"So we decided to eliminate complexity instead of managing it."

In 1982, El Paso Natural Gas had an IBM 3033, an IBM 3083 (upgraded to a 3081KX in 1983), 68G bytes of direct-access storage device (DASD) capacity, 24 tape drives, 250 workstations and a 20% per annum hardware growth rate. Most of the equipment was housed in a building that had been erected solely to accommodate large mainframe growth. Five million lines of code, developed since the 1960s in several languages, ran mostly batch processing. The firm had installed IBM's IMS/DC facility for on-line use but found it costly, time consuming and inflexible, Evans said.

Major users groups within the company had their own satellite data processing groups, which led to disputes over, or advocacy of, individual pieces of software, Evans said. "One financial software system had 13 versions for different groups," he added. When senior management argued that there was no reason for costs to grow at such a rapid rate, MIS responded that it was only getting the users what they wanted.

Management did not accept that expensive growth was the only option, so studies were initiated to look into alternatives. After the studies,

See MAINFRAME page 40

Motorola Introduces Allied Powers.

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IBM 9370 line puts pressure on lower end PCM makers

By David Bright

With its latest IBM VM/CMS-compatible departmental processing system introduced just nine months ago, Canaan Computer Corp. boasted a two-to-one price/performance advantage over IBM 4361 systems.

But in October, IBM announced its 9370 line of minicomputers, which utilizes the 370 architecture, and suddenly Canaan saw its advantage disappear. The 9370 family is believed to offer price/performance figures similar to the Canaan DCS 5800.

The 9370 line could spell trouble for vendors of smaller plug-compatible machines (PCM) like Canaan and for National Advanced Systems Corp. (NAS) and Nixdorf Computer Corp., which offer slightly more powerful systems.

Because of the 9370 line's arrival, the lower segment of the market is entering a "whole new area of plug compatibility," says George Colony, president of Forrester Research, Inc. in Cambridge, Mass. "There was not a machine in the Canaan class before," Colony notes. "But now the 9370 has fallen right on top of Canaan. I think they're going to have some troubles."

However, the 9370's introduction could be followed by announcements that would improve the price/performance ratios of those PCM vendors.

With base prices that range from $31,000 to $190,000, IBM's four 9370 models provide performance ratings from 0.5 million instructions per second (MIPS) to 2.6 MIPS.

Of these three PCM vendors, Colony says Nixdorf could fare best because its price/performance figures are competitive with the 9370 line. But Canaan and NAS are caught in the middle of the Digital Equipment Corp. and IBM battle, he says.

Colony predicts that in its effort to quickly obtain market share, IBM will, within nine or 12 months, cut prices on the 9370 machines by 15% to 20%. He adds that IBM will not bring out a low-end Model 10 in its 9370 line for at least two years because there is no market for such low-end machines.

Despite the recent shake-up in the plug-compatible machine market, Canaan has taken an optimistic attitude. Product Marketing Director Richard Schreiber says that IBM has essentially validated the lower end of the plug-compatible market, which will mean a larger market and greater sales for Canaan.

However, Colony points out that Canaan's attitude is reminiscent of the advertisement Apple Computer, Inc. placed in *The Wall Street Journal* in 1981 welcoming IBM to the personal computer market.

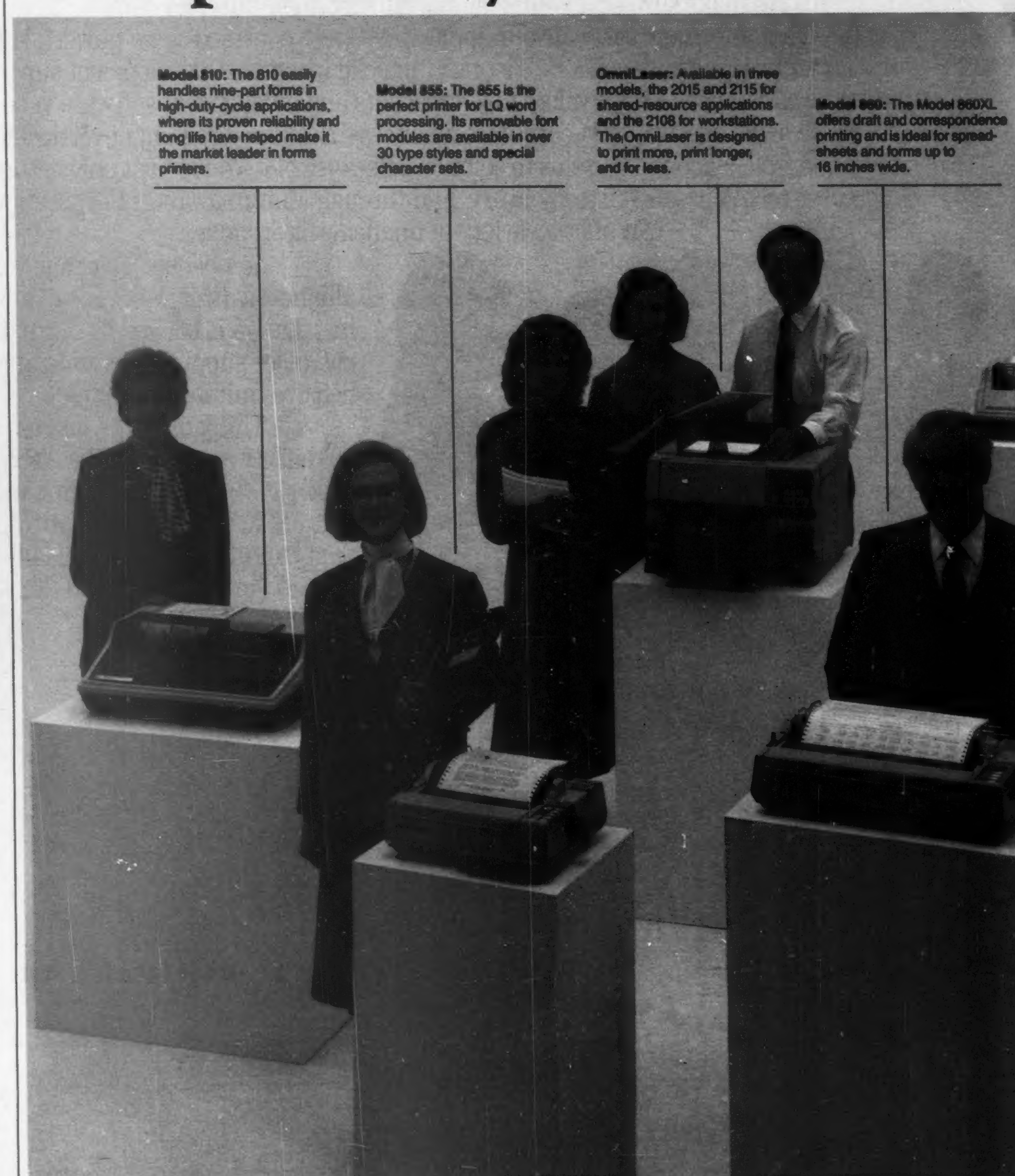
Schreiber stresses that Canaan has been selling 9370-class minicomputers for three years and that IBM's new systems will not be available until late 1987. In the meantime, he says Canaan is developing new machines with better price/performance.

Another plus for Canaan is its open architecture, Schreiber claims, noting that although the Canaan systems run standard IBM software, they also use standard Intel Corp. Multibus boards.

At present, Canaan's systems are generally priced between $50,000 and $85,000. Schreiber maintains that his company's most significant competition in this area is DEC, noting that the NAS and Nixdorf machines are "too large" to be direct competition.

A spokesman at NAS claims the 9370 line will have a "minimal, minimal impact" on his company's AS/6600 line because the overlapping only occurs at the low end of the AS/6600's range.

Like Canaan's Schreiber, he hints that the current line will soon be upgraded to a line with increased price/performance. The AS/6600 line starts at 1.6 MIPS, with a base price of $255,000.



Unix System V, Motorola 68020 ingredients in Formula

Fortune soups up supermicro line

By James Connolly

BELMONT, Calif. — Fortune Systems Corp. has revamped its line of supermicrocomputers with the announcement of systems based on the Motorola, Inc. 68020 CPU and plans to offer AT&T Unix System V on those processors.

Fortune previously sold the Motorola 68000-based Fortune 32:16 supermicro, which ran Fortune's For:Pro enhanced version of AT&T Unix System III. For:Pro will be available on the new systems, known as the Fortune Formula, although the company plans to offer System V next year and plans to concentrate on AT&T's Unix implementations in the future, according to a company spokesman.

Fortune officials claimed the Formula is designed to serve work groups of 10 to 28 users in office automation and general business environments. They said it also can be used as a dedicated processor in applications such as communications, manufacturing and engineering. The officials emphasized that use of industry-standard hardware and Unix provides users with an upgrade path and eases development of software by dealers and value-added resellers.

The 32-bit CPU runs at 16.5 MHz and processes instructions at a sustained rate of 2 to 3 million instructions per second (MIPS), and in bursts at 8 MIPS, the vendor said. Memory management is with a Motorola 68461 or 68851 memory unit. A Motorola 68881 floating-point coprocessor is optional. Basic random-access memory (RAM) is 1M byte and is expandable to 64M bytes with 1M-, 4M- and 16M-byte cards.

The basic Fortune Formula is said to provide four asynchronous ports, any one of which can be designated as the system console. However, the company said the system can be configured to support up to 80 serial ports. An optional Fortune:Link Controller is designed to allow a 255-node network of Fortune 32:16s, Fortune Formulas and IBM-compatible personal computers.

The company said that an entry-level configuration, including 1M byte of RAM, a 70M-byte hard disk and a 60M-byte streamer tape, costs $21,900.

Optical disk subsystem boosts storage

By James Connolly

KNOXVILLE, Tenn. — Perceptics Corp. has announced its Lasersystem digital optical disk storage system for Digital Equipment Corp. VAX and Microvax computers.

The Lasersystem was designed to provide more than 1G byte of data storage while being software transparent in standard DEC VMS environments.

The subsystem includes an Optical Storage International Laserdrive 1200 disk drive, an Emulex Corp. UC04/14 small computer systems interface host adapter, Perceptics' Laserware optical disk software and support.

Perceptics claimed that the Lasersystem provides full on-disk VMS-compatible directories using Perceptics' Worms-11 optical disk format. Files may be deleted, renamed and modified, and Laserware is compatible with VMS utilities such as Backup and Digital Command Language commands. Application programs may use standard I/O statements.

A Lasersystem configuration costs $21,950 for one drive, a DEC Qbus or Unibus adapter, a Laserware end-user license, cables and rack-mount slides and documentation. Additional drives cost $14,950.

HP introduces rugged, high-capacity disk drives for minis

System counteracts dislodging of heads

By Ninamary Buba Maginnis

PALO ALTO, Calif. — Hewlett-Packard Co. has announced a formatted 571M-byte disk drive designed for use with HP minicomputers and rugged enough to operate in harsh environments, including factories.

The company also announced a formatted 307M-byte disk drive. The two disk drives are the fastest HP offers, according to the vendor. Both are compatible with HP's existing high-capacity drives and are designed to increase on-line capacity of HP 3000, HP 1000 and HP 9000 systems.

The 307M-byte HP 7936 and 571M-byte HP 7937 are compact and rack-mountable. They are built with advanced Winchester technology and are the first 8-in. HP disk drives that use sputtered thin-film media — a disk-manufacturing process that gives hard media a smooth service and superior magnetic qualities, according to the vendor.

The drives feature a dual-servo system that counteracts dislodging of heads in harsh environments. One of the 14 recording surfaces is used exclusively for servo code.

The HP 7936 and HP 7937 access information at 20.5 msec. for head movement and 8.3 msec. for rotational latency. The drives support data transfer at 2.35M byte/sec. The controller then buffers the data to the appropriate channel transfer rate.

The HP 7936 and HP 7937 take up one-fifth the space of their larger predecessor, the HP 7933. The drives also consume less power and require less air conditioning than the HP 7933, according to the vendor.

The HP 7936 and HP 7937 come in two cabinet choices, with one holding two drives. A 19-in. Electronics Industry Association rack adapter is available for customers who want to mount several components in a standard rack-mount package.

An HP Interface Bus controller is built in, enabling it to operate with HP systems. This controller uses the CS/80 protocol, making it compatible with existing HP systems. A disk-controller cache is available as an integral part of the drive. The cache offers 2M bytes of random-access memory for "read cache" and a nonvolatile, single-item "write cache." The cache improves performance in some HP 3000 MPE-V and HP 1000 system applications. The disk-controller cache can be included at time of shipment or purchased later as an upgrade.

The HP 7937 with the interface bus costs $17,600. The HP 7936 with the interface bus is $13,500. Cache versions cost $2,000 more.

CSPI gives DEC systems science power

By David Bright

BILLERICA, Mass. — CSP, Inc. (CSPI) has introduced a line of attached 32-bit array processors it claims offers the best price/performance ratio available.

Offering performance ranging from 38 million floating-point operations per second (MFLOPS) to 280 MFLOPS, the Mini-MAP XL models attach to Digital Equipment Corp. VAX, Microvax and PDP-11 systems for increased computational power in signal processing applications. Key applications include seismograph exploration and medical imaging.

The array processors range in price from $32,500 to $138,250 and are compatible with CSPI's 7-MFLOPS Mini-MAP model. Features of the new line include a Fortran compiler, a library of 450 scientific subroutines, up to 64M bytes of data memory and up to four array processors per system. Four systems in the Mini-MAP XL group are targeted for typical signal processing applications, such as image processing, sonar and seismic processing. Another four models were designed for such applications as medical imaging and beam forming.

According to product manager Roger Greene, the new systems build on the strengths of the Mini-MAP system, an excellent development software with large data memory and impressive throughput. "The Mini-MAP XL incorporates these advantages while adding improved I/O capability and blazing peak performance," Greene said. "The beauty of the Mini-MAP XL is that all of the software developed for the Mini-MAP since 1982 is fully compatible."

Although the minicomputers and superminicomputers to which CSPI's array processors attach are also increasing in price/performance, Greene said there is still a big need for vastly increased computations in specific scientific applications. By concentrating on specific computation-intensive tasks, array processors can free up a system's CPU for other tasks.

Parallel Computers inks service agreement with RCA

By James Connolly

SANTA CRUZ, Calif. — Parallel Computers, Inc., which claims its fault-tolerant systems can be serviced for half the cost of nonfault-tolerant computers, has announced an agreement under which RCA Business Services Co. will service Parallel installations.

Parallel's Director of Marketing Brian Knowles reported that service for Parallel's installed base of about 90 systems, including the 200XR and 400XR supermicrocomputers, at about 50 sites had previously been handled largely by Parallel technicians at the company's service center located in California.

Such service generally required customers to ship boards to the service center.

RCA service

Under the new agreement, RCA technicians will provide service at customer sites, generally during normal business hours.

Knowles said that while Parallel's fault-tolerant capability makes it unlikely that a user would need emergency service, RCA will provide such service, and customers can negotiate 24-hour, seven-day service coverage.

Knowles said Parallel offers three basic service plans at prices ranging from 4% to 8% of hardware list prices per year.

He said that, because Parallel uses fault-tolerant technology, duplicate processors keep a system operating in case of a failure, which reduces the need for emergency service personnel.

Conventional computer service on an 8 a.m. to 5 p.m., five-day basis costs 10% to 12% of hardware costs with other vendors, according to Knowles.

Sell substance, not buzzwords

From page 33

NCR Corp., which drifted out of the mainframe business in favor of the supermicrocomputer arena and a modular superminicomputer approach. NCR has quietly strung together four quarters of sales and earnings growth. DEC continues its outstanding growth.

But it was only three years ago that even now-popular DEC saw its profits evaporate. More recently, Wang Laboratories, Inc. posted a $30 million quarterly loss despite the fact that it, like DEC, speaks of distributed processing and connectivity.

Companies like DEC, Wang and NCR are battling in a market in which vendors change their images as fast as Paris designers change styles. NCR has gone from cash registers to mainframes to communications and minicomputers.

Wang has gone from calculators to data processing to office automation, with other lines of business in between. Now DEC Chairman and Chief Executive Officer Kenneth Olsen says his company, once thought of as a hardware company and then promoted as a networking vendor, is actually a software company.

On the user side of the fence, one hears success stories about companies that dumped their mainframes for a string of minicomputers. But there are other tales of customers who committed to minicomputers that turned out to be slow as mud flowing uphill — minicomputers that never ran the software that was supposed to tie it all together, let alone tie in personal computers.

It is obvious that implementing a distributed processing solution is no different than any other business move. It matters not that one says the right things or even is the first kid on the block with a new lemonade stand. What counts is that the lemonade isn't sour and that the product and the strategy work.

Mainframe-mini switch lights fire

From page 33

MIS decided that minicomputers had advantages in price/performance and that growth would be easier to control with minis. The smaller systems offered better development and maintenance tools, spread the risks for failures and gave shorter software delivery dates and faster response times. In short, El Paso Natural Gas could do more work with less hardware, Evans said.

"We looked at 30 vendors — 20 of them in detail — for 10 major criteria," Evans said. Criteria included price/performance, application development tools, ease of use, geographical support for remote sites and communications with the IBM mainframes, because at that time the company still thought it would keep central mainframes and distribute the minicomputers.

MIS chose the Wang VS systems based on the factors listed above. "We chose the Wang system for data processing, not for office automation. We did not consider office automation factors in our criteria," Evans said.

The current installation includes six Wang VS 300s, three VS 100s, 600 Wang workstations, one Prime Computer, Inc. 9955 used as a modeling system and an IBM 3081K with 200 IBM workstations. All systems are connected together via telecommunications, with the Wang machines connected by a Wangnet network for peer-to-peer communications ability.

Mainframe use declining

"The 3081 is used at 50% to 60% of its capacity in prime shift time, and that is declining. We will be down to spinning the operating software by the middle of next year," Evans said. The software development machine, a VS 300, serves 130 users and is the only machine with a compiler.

El Paso Natural Gas decided when partially through the project not to abandon centralized processing. "We use what we call dedicated processing — with each machine dedicated to an area or set of functions. Users help schedule it and know the priorities on their machine, but we house all of them in one place," Evans said.

That place is the second floor of the company's headquarters building. Selling the former computer center building saved the company $1 million a year, Evans said. "When we get rid of the 3081, we will need only half of the second floor.

"You can run the company on minicomputer systems," Evans said. The firm does all accounting, purchasing and other financial functions on the minis. Its largest software package is an in-house-developed gas settlement calculation system that generates 70,000 settlement statements each month and writes extensive reports for government agencies.

The one million-line, 600-program package interfaces with 16 other applications, uses 10G bytes of DASD and runs on a VS 300. "I mention that because you have to be able to fit your largest application on a mini. If you can't, you need to investigate mainframes," Evans said.

Evans figures that on a per-million instructions per second (MIPS) basis, given the way El Paso Natural Gas operates, the Wang VS 100 costs $100,000, the VS 300 costs $60,000 and the IBM 3081 costs $250,000. The IBM 3090, an obvious next step for El Paso if the firm had stayed with mainframes, costs $166,000 per MIPS, Evans said. "And minicomputer MIPS are more robust than mainframe MIPS, because the operating system is more efficient."

Application development is much easier on the Wang than on the IBM systems, Evans said. "The subsecond response time we are getting keeps the programmers at the desk because they never have to wait for results. This gives us increased productivity." Programmers' jobs have expanded to include job administration and quality assurance functions, and staff members have responded well to the increased responsibilities, according to Evans.

After living with 106 modifications to IBM's operating system, Evans is glad that Wang does not allow alterations of its operating software. Batch programs can be developed three times faster than on the mainframe because of interactive compile and debug features; there has been a tenfold increase in on-line productivity. Prototyping features allow for rapid development of system shells, Evans said.

New programmers with knowledge of only Cobol can be productive in two weeks, as opposed to a six- to nine-month training period for new programmers using IBM's IMS/DC facility, he added.

Staff decreased

Evans was able to decrease MIS staff from 309 in 1982 to 203 today. The administrative function dropped from 35 workers to none. Ten applications programmers — out of an original 74 — left, and client support system analysts decreased from 95 to 61.

Areas that have increased are systems support — which grew from three to 16 workers responsible for helping users deal with personal computers and communications functions — and a few applications programmer consultants, who have been brought in for the implementation.

If El Paso Natural Gas had remained a mainframe shop, Evans said, the firm would be using an IBM 3090 Model 400 and an IBM 3081KX at this point. Including all MIS costs, he would have spent $12 million to stay in the IBM world. By the time Evans is finished installing a projected 10 VS 300 systems, he will spend $2.2 million.

Implementation is not easy, Evans said. He faced heavy resistance from MIS staff and end users. "The MIS people were afraid they would reduce their marketability by switching from IBM to Wang," he explained.

When asked by the users group attendees about bucking the "You don't get fired if you buy IBM" trend, Evans said the decision was difficult. "I think about that a lot. It's a risk. You are rocking the boat. Maybe Wang will start an old folks' home for those of us who don't make it," he said.

Wang still needs to address the quality of job scheduling, tape management and a few other tools; and El Paso Natural Gas needs more choices in general-purpose third-party applications software, Evans said. But other than those needs, there have not been too many problems, he concluded.

Slide seen in fixed disk mart

From page 33

tos-based Disk/Trend, Inc.

James N. Porter, president of Disk/Trend, said the simple explanation of lower growth rates is last year's overall flat performance of the computer industry and the fact that the annual growth percentage is computed from a larger revenue base every year.

But other factors contributing to 1985's slowed growth for rigid disk drives will continue to affect the industry in coming years.

"The principal pacing factor on the growth of rigid disk drives is software that's late, not ready or doesn't do what people want," Porter said. For example, as software becomes more complicated, he said, it must increasingly work with other software or be multiuser, which results in longer development times.

Disk drives themselves are not part of the problem, according to Porter. Manufacturers are ready and waiting. Delivery of multiuser Intel Corp. 80286 and 80386 chips would be a tremendous boost to disk sales, but "the industry needs to wait for IBM to set the standards for the multiuser 286 and 386," he added.

Market breakdown

The study breaks down the market, with individual revenue and unit shipment projections for rigid disk drives in nine separate product groups.

Highlights from the report include the following:

• Drives with removable disks, once dominant in the industry, provided only 6.8% of worldwide rigid disk drive revenues in 1985. That number will fall to 1.6% in 1989, with fixed disk drives providing the rest.

• Fixed disk drives in the 30M-byte to 100M-byte range continue to be the fastest growing segment. Worldwide shipments are forecasted to reach 1.79 million units in 1986, up 117.8% over 1985. Of those, 94.7% are 5¼-in. models, but strong growth, now beginning, is expected for 3½-in. drives.

• Shipments of drives of less than 30M bytes were 3.29 million units in 1985 and are expected to increase to 9.46 million in 1989 with major changes in the product mix. While 5¼-in. drives accounted for 88% of total shipments in 1985, in 1989 they will be almost totally replaced by 3½-in. drives, which are predicted to account for 91% of the total shipments in this segment.

• IBM's actions are expected to drive the market for 3¼-in. disk drives of less than 30M bytes. IBM began to manufacture the 3¼-in. drives during 1986, and the report forecasts 1987 IBM shipments of 730,000 of the smaller drives.

• More than 50% of all rigid disk drive revenues are generated by drives with capacities of more than 500M bytes, primarily from IBM and other producers of captive drives for use with mainframes. IBM's revenue in this sector is forecast at $5.37 billion in 1987, up only 3% from 1986. The study cites stagnant mainframe growth as the reason.

• In the international arena, the long-term prediction is for U.S. manufacturers to lose market share, but the rise of the Japanese yen against the dollar during the past year has given U.S. drive manufacturers a short-term lift. The U.S. share of worldwide shipments of OEM drives is expected to rise from 66.7% in 1985 to 69.4% this year.

Trend predictions

For 1987, Porter predicts the following trends and events:

• IBM will provide a second midlife enhancement for the 3380 disk drive product line, first shipped in 1981 and enhanced in 1985 with the dual-density 3380E. "It will likely happen in the first part of 1987. A lot of customers want better cost per megabyte," Porter said.

• A large increase in shipments of 3¼-in. Winchester drives.

• Major shipments of high-end (more than 30M-byte) 3½-in. drives, used by IBM Personal Computer AT clone manufacturers to reduce system footprints. IBM may follow suit later in the year.

• A new type of very fast disk drive that will be used in local-area network (LAN) servers. These high-capacity 5¼-in. drives in the 100M-byte to 300M-byte range will reduce access time from 30 msec to 16 msec. The result will be a dramatic performance increase for high-end LAN file servers, allowing more users to be supported.

Porter said there are five basic categories of rigid, or fixed, magnetic disk drives, including:

• 30M bytes to 100M bytes — used in high-end PCs, in LANs as servers and in minicomputers

• 300M bytes to 500M bytes — used primarily in minicomputers and some specialized systems.

SOFTWARE & SERVICES

SOFTLINE
Jeff D. Vowell Jr.

Curing backlog with relational

Throughout every systems development group goes the cry for new fourth- and fifth-generation software tools to help reduce the ever-growing applications backlog. At the same time, corporate management at all levels complains about the lack of responsiveness by the data processing group and the fact that many of those systems that do get developed do not work as they are supposed to.

In response, the data processing people buy more software to help them develop more software. Then, when the software is installed, it is either not used, takes too long to train people to use or simply cannot do the job.

A somewhat more simple and less expensive answer to these problems is good, old-fashioned, up-front design work; creation of data element independence, systems integration and, above all, adherence to standards throughout the design and development process based upon an accurate, corporate, logical data model.

With the advent of relational data base structures, this becomes a much simpler process than before. The hierarchical, network, inverted-list and other physical data base structures provided obstacles to effective usage of the logical data model. Instead, the focus was on the physical requirements and functions of the internal structure. The relational model lends itself to the actual structure, which results from the accepted logical data base design pro-

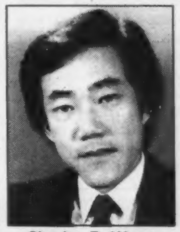
See CURING page 46

Vowell is owner and primary consultant of the Vowell Systems Group, Middletown, N.J.

Computer Associates exec plans to keep company on fast track

By Charles Babcock

Charles B. Wang founded Computer Associates International, Inc. (CAI) in 1976 with three acquaintances from Standard Data Corp., a New York service bureau.



Charles B. Wang

Since then, the company has grown into what appears to be the largest independent software vendor in revenue, with its closest rival being the applications giant Management Science America, Inc. (MSA). Unlike MSA, CAI is primarily a VSE and MVS systems house, piggybacking its products on IBM operating systems and subsystems.

Wang's company started out selling a sort utility of a European firm, Computer Associates International of Switzerland. As the U.S. distributorship built up sales, it began developing additional products on its own. Eventually, Wang says, his firm became "the tail that swallowed the dog," with the U.S. operation buying out the parent company in 1980. In December 1981, the company went public, and the growth path has been on an uphill curve ever since.

More than other software houses, CAI has grown as much by acquisition as by internal development. It acquired Capex Corp. in 1982, moving what had been a VSE systems house into the MVS marketplace. In 1983, the company entered the microcomputer software market with the acquisition of Information Unlimited Software. CAI also acquired the business applications of Stuart P. Orr and Asso-

See CAI page 49

INSIDE

Prudential purchases supplier of human resource systems/**44**

Motorola demonstrates Unix-based operating system for 68020 family/**45**

NEW THIS WEEK

- Thorn EMI upgrades its FCS decision support software for IBM mainframes

- For more on these and other new products, see pp. 115-144.

INSTANT ANALYSIS

"The focus of development is clearly on MVS/XA. It will continue to be the flagship of the fleet for large-scale production systems."

— Richard B. Butler, director of IBM's Myers Corner Lab, Poughkeepsie, N.Y.

SOFTWARE NOTES

Business Software acquires Condor

Business Software Technology, Inc. (BST) of Westboro, Mass., has acquired Condor Technology of New York, originator of the **Control-1** source code change management system for IBM MVS sites. Control-1 is used by Empire Blue Cross of New York, Manufacturers Hanover Trust Co. and Mellon Bank NA. BST is a 2-year-old start-up founded by former Cullinet Software, Inc. executives who brought the **Run Time Evaluator**, a performance monitor for sites using Cullinet's IDMS/R, to market.

■

Attendees of the **Ingres User Association** in Philadelphia last week were given a preview of **Ingres/PC**, **Rela-**

See NOTES page 49

APICS is forum for manufacturing tool debuts from Cullinet

By Rosemary Hamilton

ST. LOUIS — Software packages for manufacturing applications from Cullinet Software, Inc. and other companies were rolled out at the annual American Production and Inventory Control Society (APICS) conference here recently.

Cullinet announced two packages for repetitive manufacturing applications, both of which resulted from its recent acquisition of Computer Strategies, Inc. (CSI) of Grand Rapids, Mich. One is an existing package that had been sold by CSI for the Digital Equipment Corp. VAX market, and the other is an enhanced version of the Cullinet Manufacturing System, which runs on IBM mainframes or compatible systems. The VAX package will continue to be sold by CSI, now a Cullinet subsid-

See SOFTWARE page 49

Candle widens features on Omegamon CICS-user package

By Eddy Goldberg

LOS ANGELES — Candle Corp. recently announced four additional features in its Omegamon performance monitoring software for IBM CICS/MVS. Version 407 includes impact analysis, recommendation menus, introductory menus and impact profiles, all designed to boost programmers' ability to increase system availability.

The Impact Analysis feature provides information about the environmental factors affecting CICS performance, including other work loads and other CICS regions. It helps the user identify what other address spaces are affecting CICS performance, which allows for tuning of the entire CICS/MVS system, said Buff Jones, CICS product manager.

Recommendation menus complement Omegamon's Exception Analysis feature. When an exception message is displayed as the result of system performance, violating the user's pre-established performance level, a system analyst can call up the appropriate recommendation menu. This yields an explanation of the problem, describes its possible causes and outlines steps to solve or further analyze it.

Jason Fox, system programmer at Ciba-Geigy Corp. in Ardsley, N.Y., said the recommendation menus make life easier for operators. "The new feature offers suggestions on how to fix what's wrong," he said. The recommendation menus also can be customized. Another benefit is that nonexpert CICS programmers can refer to recommendation menus for advice, Fox added.

Fox said Omegamon 407 runs with 10 CICS regions on an IBM 3090 Model 400. He has been using Omegamon for the past seven years to monitor the CICS regions. "When you know there's a problem in the system, Omegamon will tell you where it is, so you don't have to do any hunting. It can usually point out exactly what's going wrong," Fox said.

Fox said there is a hotline at Ciba-Geigy for user problems. "The first thing we do when we get a call is check Omegamon," he said.

"Our products originally were designed for the super CICS expert," said Pat Page, marketing consultant at Candle. "But CICS is beginning to grow rapidly and there's a real shortage of these people now."

Impact profiles provides the user with a graphic display of the effects that work loads are having on CICS, providing a quick glimpse of system function, Candle spokesmen said.

Omegamon Version 407 for MVS/CICS is fully compatible with IBM's CICS 1.7 and is integrated with Candle's RTA/CICS and ESRA/CICS. The price for new customers is $23,500, with a version for extended architecture costing $25,500.

Prudential buys Tesseract

By Charles Babcock

Prudential Insurance Co. of America has purchased a small, San Francisco-based supplier of human resource systems and plans to aggressively market its products in the U.S.

Tesseract Corp., whose systems are in use at General Motors Corp., TRW, Firestone Tire & Rubber and Goodyear Tire and Rubber Co., has been noted for eight years as a vendor of IBM mainframe human resource systems to major corporations. Its suite of integrated products cover personnel, payroll, benefits and claims. But President Charles J. Yazel acknowledges, "We have never marketed them well; we have never sold them well."

Furthermore, the 80-employee Tesseract, unlike most software companies, was dependent on its clients for much of its development money. A group of customers would set specifications and jointly fund a development project. "Our whole payroll product was developed that way," said Yazel, a former vice-president of Tandem Computers, Inc.

Tesseract's acquisition by Prudential a month ago is slated to change that. It now has a bankroll of $2 million for development and plans to double its employees in 1987. It started 1986 with three salesmen; it plans to field 22 in 1987, Yazel said.

It has also spent $700,000 on computer equipment to speed its development capabilities. In the past, programmers worked late at night or on weekends to gain access to the terminals in short supply at Tesseract, Yazel recounted.

Prudential acquired Tesseract for an undisclosed amount because its human resource systems added a product to the services a large insurance firm can offer its employer-customers, said John LeDell, vice-president of the Prudential Group Department, which will oversee the acquisition.

Tesseract's revenue in 1985 was $4 million. They are projected to grow to $7 million in 1986 and $15 million to $16 million for 1987, when the first effects of the Prudential acquisition will be felt, according to Yazel.

Expert systems may change red tape to magnetic tape

By Mitch Betts

MCLEAN, Va. — Expert systems may dramatically change the way the U.S. government handles the tasks of public administration, if the prototype systems developed by researchers are ever used in the bureaucracy.

Speakers at the Expert Systems in Government Conference, held in McLean recently, described expert systems for use in processing welfare claims, responding to nuclear power plant emergencies, retrieving information from data bases and helping jet fighter pilots plan their missions.

Artificial intelligence researchers at the National Oceanic and Atmospheric Administration in Boulder, Colo., reported that they have begun to develop weather forecasting systems for use by the National Weather Service.

"Today, the main topic of discussion is not if expert systems may be applied within goverment and industry, but how and when they may be best utilized," said conference organizers Kamran Parsaye, president of Intelligenceware, Inc., and Barry G. Silverman, director of the AI institute at George Washington University.

A clear-cut government application of expert systems is the processing of welfare or medical claims, which are handled by computer systems and require rule-based decisions, according to AI scientists.

J. Walter Vera, a researcher at Mitre Corp. in McLean, described an expert system that compares a hospital bill submitted to the government for reimbursement with a knowledge base of the rules and judgments that is used to either accept or reject the claim.

He said the expert system could cut government costs and provide better and more consistent service and would be easy to maintain when new legislation changes the rules.

"The policies and regulations which cover the resolution process can be contained in a knowledge base in an easily understood format, rather than the typically obscure code of procedural languages.

This allows maintenance to be performed by individuals with an in-depth knowledge of the policies and regulations, rather than by a programmer without such knowledge," Vera reported.

Researchers at the conference described a variety of other government-related applications:

• The U.S. Nuclear Regulatory Commission (NRC) is supporting development of an expert system to help its emergency response team analyze critical data during a nuclear power plant meltdown.

"The very complexity of determining successful strategies for severe accidents requires consideration of expert systems," said James P. Jenkins, program manager for accident management at the NRC's Office of Research.

• Likewise, the U.S. Department of Energy has funded the development of an alarm filtering system for nuclear power plants. The system indicates to operators which alarms require top-priority attention.

One or two problems in a power plant triggers about 500 alarms, according to Dan Corsberg of the Idaho National Engineering Laboratory, thus giving operators a severe case of information overload.

• The U.S. Postal Service sponsored research on a document analysis system that can locate the destination address block on envelopes, something that its optical character readers have trouble doing. The expert system had a success rate of 85%, compared with 65% for the optical character recognition equipment.

Motorola offers Unix version

By Eddy Goldberg

NEW YORK — Motorola Computer Systems, Inc. demonstrated the System V/68 Release 3 Operating System, the company's implementation of AT&T's Unix System V Release 3, for its 68020 family of computer products at Unix Expo recently.

System V/68, which will be available in the first quarter of 1987, was shown running with Network Services Extensions, Motorola's version of AT&T's Remote File System (RFS) implemented for the MC68020. RFS allows transparent file access across different Unix systems.

The system was produced to comply closely with AT&T's Unix V.3, said Dale Ouimette, manager for systems marketing at Motorola.

System V/68 is object code-compatible with Motorola's previous Unix product, System V/68 Release 2. It will be offered in four levels. The generic basic version will be offered to the company's MC68020 chip and board customers via source licensing. The enhanced version will be available to the company's OEM VME computer systems, as well as in its Vision/32 and System 8000 products, targeted at value-added reseller and end users.

In response to questions on Motorola's commitment to support its customer base, Ouimette emphasized the company is "here to stay in the computer industry."

Curing backlog with relational

From page 43

cess known as normalization.

As a result, it is possible to use the relational data base to design its own data bases and enforce many naming standards and adherence to the logical data model design.

To use the relational data base as a design tool, you must first mandate the use and enforcement of naming standards. Then you must either create a logical data model or use a current design and input it into a set of relational tables using a front-end editing system.

With the editing system, designers may input the data element descriptions and names for their logical data bases, including the various relationships such as one-to-one, one-to-many, etc.

After the logical design is completed, you can generate the data base generation statements for your particular relational structure as well as a pictorial representation of the data model itself.

Screen painting

Then, by using screen painting, you select the data elements for that particular screen, making sure you use the same names that were defined in the logical design. This will create the screen definition for whichever data communications monitor or screen manager that is used and an appropriate program skeleton for processing that screen.

Because of the similarity of the logical design to the actual relational structure, the next step becomes a much simpler process. The individual data elements have been previously defined in the table structure and can be accessed by element, depending on the element type (primary or secondary key, key descriptor, etc.). Each element can then be accessed and the appropriate data manipulation language created, as well as Cobol and PL/I definitions and Call statements, without regard for master/variable relationships, parent/child relationships, etc.

By selecting various functions (such as ADD, DELETE, UPDATE, VIEW) for particular data elements, further additions to the previous program skeleton can be created. The basic processing will now be finished and created in a program, in which you can now edit to add various unique checks and functions.

The key to the production of the source code is a set of standardized program skeletons, an enforcement of usage of the naming conventions and an understanding of the functions of the particular languages and data communications monitor used.

It is true that this will not create all the necessary program code, but it will create most of it. The addition of query and report generators that are integral parts of most relational data bases will eliminate the need for many program-generated reports and, through the use of the various on-line interfaces, can make many of these become standard production-type systems without any coding. Whole systems can be produced quickly because of the reduction of time spent in reproducing code and functions that are the same in most programs.

Skeleton concept

By enforcing standards and the use of this "skeleton" concept, much of the time spent by individual programmers in supposed creativity is eliminated, which is where the majority of time is spent and where most of the problems occur later in terms of maintenance and the addition of changes.

The ideas of logical design and standardization are not new. Even relational data base structures are not new. But the ever-increasing end user demand for data processing services and the greater realization of the necessity of the effective usage of data processing — as well as the need for quick response to change — mandates a quicker solution to the problems of productivity.

The use of fourth-generation software does not seem to be resolving much of the problem, probably because of costs associated with the initial purchase, the need for additional training and programmer resistance. These systems cause other problems in the areas of systems integration and enforcement of standards.

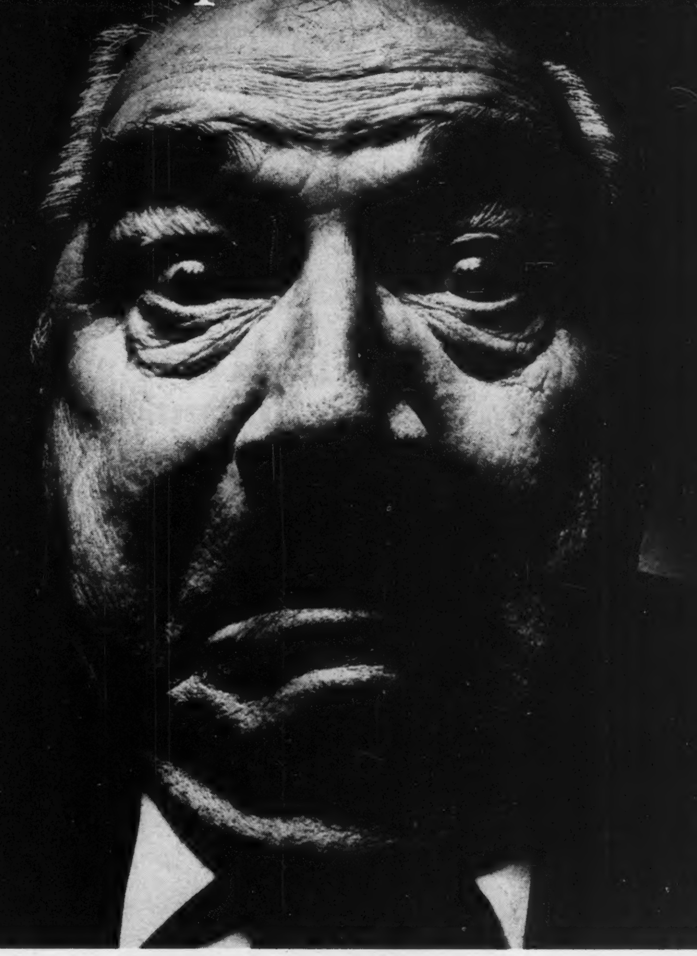
The ideal of roll-your-own applications generators can be implemented relatively inexpensively. They combine the necessary ideals of logical design and corporate integration with the absolutely necessary features of standards enforcement. They also will produce systems without using new or unknown techniques, produce source code in a language that is known and modifiable (Cobol, PL/I, etc.) and use the software that is already in the shop.

This solution seems somewhat simplistic, and it is. For years the implementation of data element independence has been preached as the answer to the dependence upon physical data base structures. The costs of training a person in that physical structure and of hiring already-trained personnel continues to rise.

The advent of commercially viable versions of the relational data base structure can eliminate the need for most of that specialized training and result in much greater productivity.

It is time to learn from past mistakes. The relational data base will be the cornerstone for every data processing department in the near future. Start using it correctly now to help solve current problems and to avoid recreating these same problems we currently face in using existing data base management systems.

Watch what happens next time you ask a mainframe software vendor for a complete customer list.



You may get a convincing song and dance, but underneath it's a different story. Behind those pat answers that software vendor is actually sweating and squirming.

Why don't they want you to see a complete list? Simple. They know that their size and name familiarity do not guarantee happiness. Many "single source" or "all-things-to-all-people" vendors have, at best, uneven quality across a multi-application product line. They know that their customer list may contain a good number of less-than-happy clients. It's difficult for these vendors to commit the human and monetary resources necessary to produce the type of superior product available from a firm that specializes in a single application area. A firm like Data Design.

Data Design develops mainframe financial applications software. Period. We understand all our users' requirements and are therefore able to provide the necessary support: over 40 percent of our support and installation staff are CPA's or have MBA's.

Data Design doesn't balk at giving prospective customers a *complete* customer list. That's because hundreds of FORTUNE 1000 companies have reaped exceptional results from our financial software systems. Alcoa, Gerber, Pillsbury, Sherwin-Williams, Merrill Lynch, Bankers' Trust, Bristol-Myers, Federal Express, Litton, Lloyd's Bank, The New York Times Company, Owens-Corning, Royal Business Machines, Warner-Lambert and hundreds more have opted for Data Design over other major vendors. Write for our complete customer list and ask *anyone* on it about our fast, trouble-free implementation; system flexibility and ease of use; in-depth training and responsive, knowledgeable support; *management level* people in customer service positions, and more.

You'll find that people who want financial software relief choose Data Design. Since 1973, nationally recognized independent software surveys have confirmed Data Design's unsurpassed record of user satisfaction—year after year. That's why we'll give you a complete customer list—and *they* won't.

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CAI exec plans for fast track

From page 43

ciates, Inc. and further committed itself to the micro market in 1984 when it acquired Sorcim Corp. Meanwhile, CAI added to its mainframe product line through the acquisitions of Arkay Computer, Inc. in 1984 and Value Software, Inc. and CGA Computer, Inc. in 1985.

Wang runs CAI with a highly personal style, circulating through the Garden City, Long Island, headquarters in New York calling many employees by their first names and bringing his brother, Anthony, into the firm as president and chief operating officer. The Wang family emigrated from mainland China, and, Wang says, "There's no land of opportunity like the United States."

The following interview was conducted by Charles Babcock, *Computerworld*'s senior editor for software.

CW: You reported revenue of $191 million for fiscal 1986, which ended March 31. How does 1987 appear to be shaping up?

WANG: Wall Street analysts project something like $255 million.

CW: Cullinet Software, Inc. just reported a losing quarter. Do you expect to reach $255 million?

WANG: I think it's realistic. We always project a growth of 30% to 35%. It's actually higher. We just reported second-quarter revenue of $63.5 million, up 51% from the year before. Net income was up 105%.

CW: What's moving for you?

WANG: The thrust of our business is in the systems products area. Our products are not a major capital item expenditure. They are also designed to automate the DP installation. In times when there is a perceived slowdown or curtailment of spending, DP managers often look for another solution. Instead of buying four more disk drives, they may opt to buy a disk management system.

CW: IBM just reported a slackening in the growth of its international sales. How have they fared for you?

WANG: We have a very strong foreign or international operation. Forty percent of our revenue is based in the international marketplace. The tact we have taken is to establish local companies in the countries where we do business. In [West] Germany, France and Italy, we are the largest independent software house.

CW: Don't you find your accounting applications face tough competition from MSA, McCormack & Dodge Corp. and others?

WANG: Our products work from MVS right down to VSE. Where we're having more success is probably in the VSE market.

CW: What's moving in the MVS area?

WANG: In the systems area, the whole product line: production management, resource management, job accounting.

CW: Let's consider IBM. IBM has never been too preoccupied with system utilities. They're not in there pitching one utility after another.

WANG: I don't think IBM really pitches software. I think they take orders for software. I don't think this is something that's new. I mean, IBM is a hardware company. They give you 10 more million instructions per second. Then they give you a new operating system that uses 11, so where are you? You've got to get another new machine anyway.

CW: Do you see them being more active in your line of business?

WANG: We've seen a lot of them even in the past from a couple of vantage points. But our strategy is to add value to IBM base products.

CW: You have entered the data base management system market with CA-Universe, but I don't know Computer Associates as a data base management system vendor.

WANG: It's a good engine plus great tools. If somebody wants to use [IBM's] DB2 engine, then they can still buy the tools. We have an installed base of about 250.

CW: Is CA-Universe actually a compatible system with DB2?

WANG: No, not today. That is the goal. I don't know what the exact development schedule is.

CW: How is the micro area doing for you?

WANG: The micro area has not met our expectations. It is breaking even.

CW: What is the problem there? A great deal of competing products?

WANG: Everybody has written their own by now. In micro software marketing, the thing that has been lacking in the past is the whole aspect of service and support. People feel, 'I'm spending $400 to $500 on a product.' You know it's a cheap product, as people say. And therefore the vendor is reluctant to provide support. But that is how we have built a loyal following on the mainframe side, with support.

CW: You are trying to build your micro customer base, a process that is not necessarily highly profitable?

WANG: There isn't a lot of revenue for that. As a whole, the micro division does make a nominal profit. The second quarter was quite a bit better.

CW: Are you still acquiring micro products?

WANG: We look to see what we can leverage off whatever investment we have made. . . . We have plenty to do right now with Supercalc 4, Super Project and Easy Business.

CW: Who makes decisions on acquisitions?

WANG: It's a team effort, though I do have the veto power. It's sort of a group effort to look at a company. Since we have a good distribution force, we will look at how we can best leverage off our product base. We want to make two plus two equal six, or eight or 100.

CW: Is your pace of acquisition likely to continue?

WANG: Yes.

Software out at APICS

From page 43

iary, and the IBM package will be marketed by Cullinet.

The VAX package is currently available to run under the Pick operating system from Pick Systems, or on the Honeywell, Inc. DPS-6. The IBM package, currently in beta test, is scheduled for shipment in early 1987.

Along with the software announcements, Cullinet said it had beefed up its consulting services for manfacturing customers.

The Cullinet Manufacturing System-Repetitive is an extension of Cullinet's existing manufacturing software and will continue to be sold to discrete manufacturers or those that develop products on a made-to-order basis. Cullinet used CSI's repetitive manufacturing expertise to extend the mainframe manufacturing system's functionality, according to Tom McDoniel, director of commercial products.

CSI, which McDoniel said had "just about cornered the market in repetitive manufacturing," worked with Cullinet to "extend our applications." He added, "CSI had just started to move into the IBM marketplace, and that's one of the things that brought us together."

Both products are made up of eight modules for the manufacturing process, including bill of materials, inventory and shop floor control. The repetitive package will sell for the same price as the existing product, according to the vendor. Starting at $70,000, the combined package can cost $560,000 if all modules are purchased. Those current users on maintenance contracts can upgrade as part of their annual software renewal fee, Cullinet said.

The VAX repetitive manufacturing software, which ranges in price from $100,000 to $180,000, is similar in principle to the IBM package. It consists of six application modules for the manufacturing process.

The following products were also announced at the APICS conference:

- Western Data Systems said its manufacturing management software, which it had been selling for Hewlett-Packard Co. 3000 minicomputers, is now available on IBM mainframes and will be available for IBM's recently announced 9370 mid-range system early next year.

The Compass Contract is designed for aerospace and defense contractors and financial and contract management in a manufacturing environment. It includes applications for cost accounting, quality control and government reporting. The package has a base price of $300,000 and runs under both the IBM MVS and VSE operating systems on IBM's 4300 systems through its high-end 3090 series. It will range from $100,000 to $200,000 for the 9370 series.

- Tandem Computer, Inc., maker of the Nonstop computers for on-line transaction processing, said it teamed up with Thomas-Laguban & Associates Inc. (TLA), which sells the Interact factory automation software. Under terms of the agreement, TLA will sell its software, used for shop-floor planning and control, to Nonstop users in factory environments. The software is customized for users' needs and includes a TLA-designed data base for manufacturing-related data.

Notes: Oracle, Wang sign up

From page 43

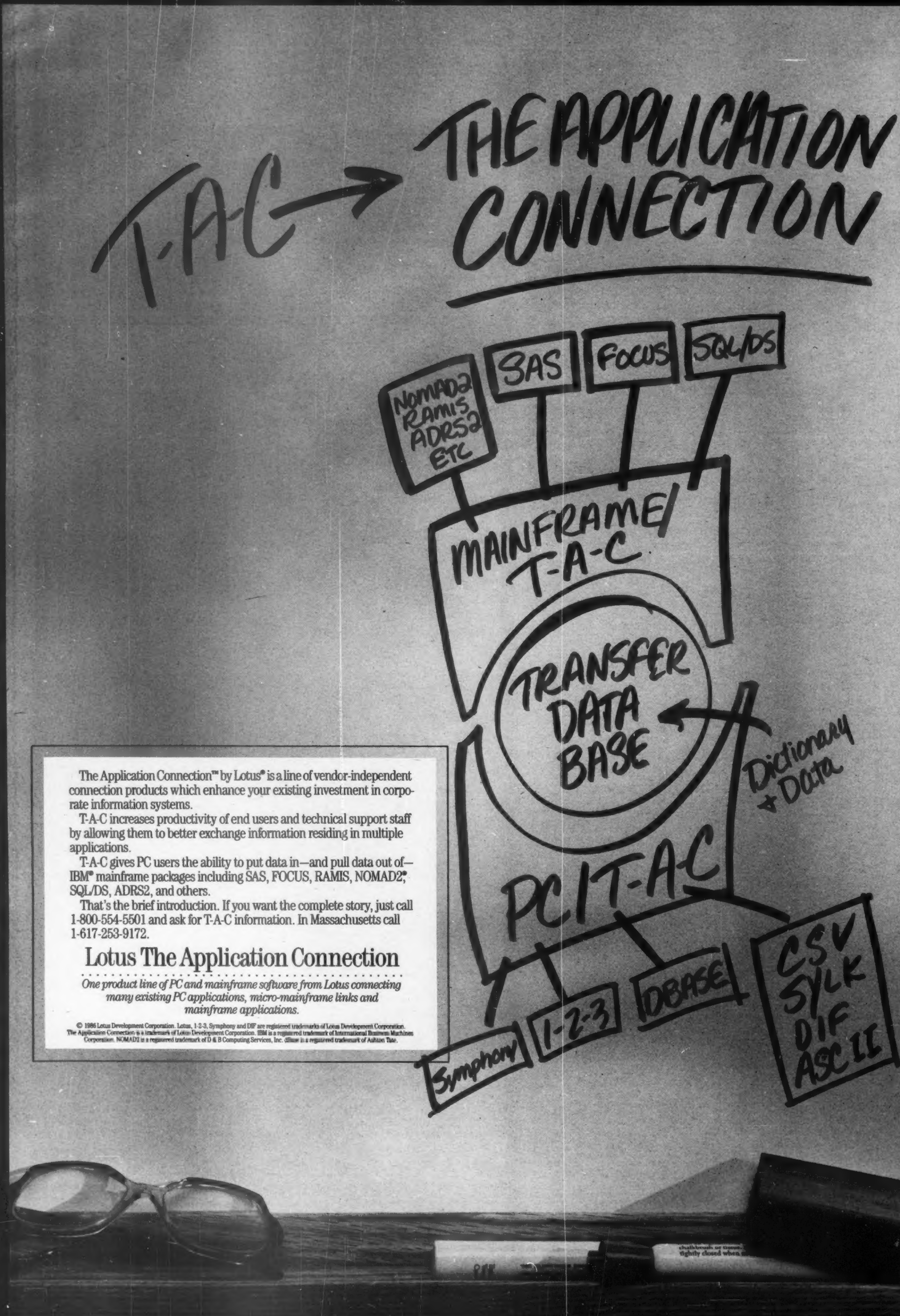
tional Technology, Inc.'s personal computer-based version of the relational data base management system. A 1987 debut is planned.

■

Oracle Corp. has signed an agreement to port its products to the **Wang Laboratories, Inc. VS** series of minicomputers and the Wang desktop microcomputers.

■

Seventy-four percent of the insurers in a survey conducted by **Pallm, Inc.** said they used packaged software from independent suppliers rather than developing all their systems in-house. A year ago, the figure was 69%, according to the Indianapolis supplier of software to the insurance industry. Client management and reinsurance packages were among those most in demand, spokesmen said.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SQL/DS
MAINFRAME/ T-A-C
TRANSFER DATA BASE
Dictionary + Data
PC/T-A-C
Symphony
1-2-3
DBASE
CSV SYLK DIF ASCII

COMMUNICATIONS

DATA STREAM
Walter Ulrich

Class costly for Zapmail

Like the proverbial Thanksgiving turkey, Federal Express Corp.'s Zapmail service will not survive the end of November. But Federal Express is nobody's fool, and Zapmail is no technological turkey. What happened? Why? And what are the implications of Zapmail's failure to thrive for other facsimile-based services?

On the surface, Zapmail had everything going for it. Federal Express is a $2.6 billion company that has become the IBM of the air courier industry. Its visionary founder, Fred Smith, recognized early the high value of computer communications. The company was quick to apply radio, microwave and satellite technologies to improve service levels and reduce costs.

In the early 1980s, Federal Express recognized the potential threat and opportunity of electronic document interchange. The company developed a service that would electronically transmit documents across the country within two hours. The firm could then leverage its courier force by picking up documents and/or delivering them to their destination. Federal Express set the standard for overnight delivery, and now it intended to do the same for same-day delivery. Facsimile technology was selected as the vehicle.

Facsimile-based services had a history of failure. ITT's ill-fated Fax Pak could not even be given away in the early 1980s. The U.S. Postal Service's Intelpost fiasco has been the source of

See **CLASS** page 59

Ulrich is a partner with Coopers & Lybrand and manages the Walter Ulrich Consulting subsidiary in Houston.

Datapoint powers up LAN

Adds power, connectivity to gain market position

By Alan Alper

SAN ANTONIO — Attempting to strengthen its position in the departmental computing arena, Datapoint Corp. recently unveiled enhancements that add power and multivendor connectivity to its Arc local-area network (LAN) system.

Datapoint's latest additions to its Arc line of network servers incorporate the Intel Corp. 80286 microprocessor, with a future migration path to the more powerful 80386 microprocessor, the company said. The Starship II host system can be configured with two to four tightly coupled 80286-based processors that share access to memory, I/O channels, controllers and other devices over a 32-bit internal bus. It supports between 40 and 150 users, operates at 3.2 million instructions per second and delivers throughput of 2,616M byte/sec., Datapoint said.

Datapoint also released RMS/XA, an enhanced version of its Resource Management System (RMS) designed to coordinate multiuser resource sharing on the Starship II system. The new operating system integrates data generated by or stored on equipment from different vendors, making it accessible to users in a uniform format, Datapoint said.

RMS/XA supports multiple operating systems such as Unix, Digital Equipment Corp.'s VMS and Microsoft Corp.'s MS-DOS and is compatible with existing RMS implementations, allowing the Starship II to become another resource-sharing unit, along with other Datapoint processors, on Datapoint's Arcnet LAN. Datapoint work-

See **DATAPOINT** page 59

Data equipment grabs larger slice of budget pie

By Elisabeth Horwitt

ELLICOTT CITY, Md. — A 132-company survey recently completed by Newton-Evans Research Co. found that data communications managers expected to spend an average of $1.472 million each on data communications equipment next year. This represents a 44% cumulative growth rate since 1984, when the average data communications budget was $1.019 million.

Budget plans for 1987 call for an average 11.1% increase over 1986 levels, while the average budget increase from 1985 to 1986 was only 7.9%, the report noted.

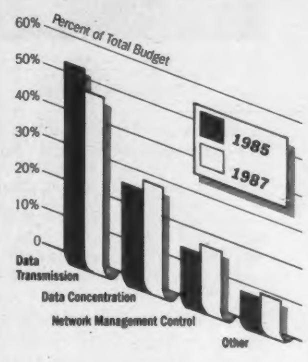
On the average, respondents told Newton-Evans they plan to allocate half of their 1987 budgets to data transmission equipment, about 30% to data concentra-

See **DATA** page 57

MITCHELL J. HAYES

Communications budget allocation

Data communications departments to allocate more money to network resource control and less to transmission



Information provided by Newton-Evans Research Co.

INSIDE

NEW THIS WEEK

- A 19.2K bit/sec. connection between Apple's Macintosh and Northern Telecom's Meridian SL1 PBX is announced

- For more on this and other new products, see pp. 115-143.

INSTANT ANALYSIS

"Anyone who understands it should come to work for Microsoft as a product manager."

— Bill Gates, chairman of Microsoft Corp., talking about connectivity

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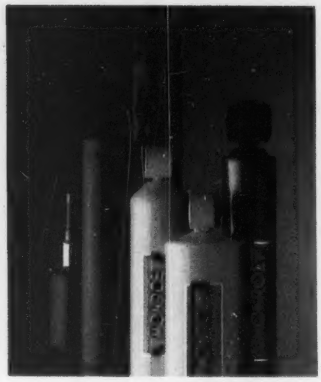

BENEFICIAL DID.

A financial services company in a state of rapid growth needs a state-of-the-art information system technology. That's why Beneficial Corporation turned to Cullinet Software and its three-level integration. Serving credit, banking and insurance customers around the world, Beneficial will utilize Cullinet's IDMS/R, Fourth Generation Applications and Information Center Management System. Together they will give Beneficial the speed and accuracy that sets their financial services apart. Beneficial recently bought Cullinet applications packages to handle everything from general ledger to human resources management. And they're convinced that the flexibility and responsiveness of Cullinet's relational architecture will let them react quickly and positively to the pressures of a highly competitive business environment.

MONROE DID.

The ability to leverage production with truly efficient decision support is what put Monroe Auto Equipment on the road to Cullinet's IDMS/R, Manufacturing Applications and Information Center Management System. The world's leading manufacturer of automotive ride control systems, including popular Monroe shock absorbers, and struts, they were impressed with Cullinet's broad product offering. Their objective: reduce inventory, cut scrap, and improve labor efficiency. Cullinet software will help them meet those objectives. Cullinet's technological superiority will allow Monroe to improve planning of its manufacturing operations (manpower, machines and materials) while it helps generate a production schedule that more closely corresponds to its customers' requirements. The Cullinet solution will make business run more smoothly at Monroe.

COSMO OIL DID.

Three oil companies merged to create Cosmo Oil – Japan's third largest supplier of petroleum products. That also created the problem of trying to coordinate three disparate methods of importing, refining and distributing petroleum. Cosmo's management team agrees they would not have been as successful without Cullinet products and the leadership and timely support of Cullinet's Japanese representatives. They installed IDMS/R in October of last year. Within five months, it was running every facet of Cosmo – from petroleum import to sales and accounting. The system quickly improved distribution and inventory management, and reduced system development times. Cullinet has allowed Cosmo to meet the challenges of their business in a fraction of the time and at a fraction of the cost of competitive systems.

Carcel launches telecom voice/data multiplexing technology

'ISDN forerunner' sold to operating companies

By Stanley Gibson

SARATOGA, Calif. — A digitized voice and data multiplexing technology purported to be a forerunner of the emerging Integrated Services Digital Network (ISDN) standard is now being marketed to divested Bell operating companies by Carcel Telecommunications, Inc.

Jointly developed by Carcel President Gregg Carse and Pacific Bell, the technology enables ordinary telephone lines to support multiple voice and data channels handling aggregate rates of up to 80K bit/sec. over local-loop distances of up to 18,000 feet, Carse claimed.

Pacific Bell recently implemented the technology in its trial user network Project Victoria and is currently awaiting Federal Communications Commission approval to offer it to customers as a tariffed service.

By enabling one telephone line to carry multiple transmission channels, the Victoria technology provides high potential cost savings to both the telephone companies and their customers, Carse said. "Imagine being able to simultaneously have several people making telephone calls, and two IBM PCs sending or receiving data, all over the same telephone line."

The Victoria technology will enable regional carriers to deliver ISDN functionality long before ISDN is actually in place as an industry standard, Carse claimed. He stressed that ISDN protocols can be incorporated as they emerge, so that users of Victoria-based systems will not be stranded when the standard arrives. The two technologies could coexist, with Victoria on the local loop and ISDN on the other side, he added.

Although Victoria was designed for Pacific Bell as a seven-channel (five data, two voice) system, Carse said it can provide a customized number of channels as needed. An upcoming version of the technology will handle aggregate transmission speeds of up to 144K bit/sec. over ordinary telephone lines, he said.

Pacific Bell tested the system in 200 homes in Danville, Calif., earlier this year.

However, regulatory hurdles encountered by Pacific Bell may delay the time when Victoria's cost-performance advantages become available to users as a tariffed offering, according to Michael Eastwood, the company's executive director of new network applications.

The divested Bell operating company has proposed using the Victoria system as a user gateway to its X.25 packet-switching network.

Federal Communications Commission regulations dictate that Pacific Bell's competitors are entitled to use the Victoria system as a gateway to their own packet-switching services at the same prices paid by Pacific Bell. The company is filing a proposal to meet those conditions, it said.

Classification snag

Another area of concern is whether the black box that interfaces the customer's data and voice equipment to a local telephone line should be classified as a multiplexer or as customer premises equipment for regulatory purposes.

If classed as customer premises equipment, its patented design would have to be disclosed. If considered a multiplexer, the equipment would be exempt from disclosure, according to Second Computer Inquiry regulations.

The FCC is still debating this point, Eastwood said. He added that even if the FCC decides the black box is customer premises equipment, and Pacific Bell is forced to reveal the box's design to competitors, the company will still continue with the Victoria program, though it will is likely to change its tariff proposal.

PCs get link with TCP/IP

By Elisabeth Horwitt

Ungermann-Bass, Inc. recently announced TCP-PC, a hardware and software product that enables IBM Personal Computers to communicate over a local-area network (LAN) using Transmission Control Protocol/Internet Protocol (TCP/IP). The product is the first of a series of planned offerings that implement the multivendor communications standard on Ungermann-Bass's Net/One LAN.

"It has become increasingly clear in the last nine months that our customers are not willing to wait for Open Systems Interconnect standards to provide them with multivendor connectivity," said Ungermann-Bass product marketing manager Bart Burstein. "They say, 'TCP/IP is not perfect, but it's here now.' "

An interface between TCP/IP and Netbios, the emerging IBM Personal Computer network software standard, is built into the TCP-PC product. As a result, IBM PC software

See PCs page 57

COMMUNICATIONS

HP adds to protocol analyzer line

By Jeffry Beeler

PALO ALTO, Calif. — Hewlett-Packard Co. has enhanced its network management capabilities with wide-ranging hardware and software additions to its family of protocol analyzers.

Included in the recent announcement are the Model 4952A protocol analyzer, a portable troubleshooting device that operates at 64K bit/sec., and the 18212A, a performance analysis program for HP's existing 4971A local network analyzer.

HP also unveiled three software enhancements that allow the 4953A protocol analyzer, an existing product, to support IBM's Systems Network Architecture (SNA).

The 4952A protocol analyzer represents a breakthrough in price/performance and downsizing, HP claimed. "Products with comparable features typically cost twice as much as the 4952A and occupy twice the volume," said Ric Bechter, the analyzer's product manager.

In addition to supporting transmissions as high as 64K bit/sec., the unit comes with an optional 750K-byte buffer memory and can decode SNA data flowing through a CCITT X.25 packet switching network, Bechter said.

The 4952A box is small enough to fit under an airplane seat. Portability is among the device's chief selling points, according to Bob Bauman, a quality assurance and product testing specialist for Infotron Systems Corp., a large user of HP protocol analyzers.

Bauman described the 4952A as primarily a field service tool rather than a replacement for the "$20,000 scopes that users already have in their laboratories." With it, he said, "a field engineer can travel to a remote site and figure out where a problem lies."

The 18212A software package enables users of HP's existing 4971A protocol analyzer to automate certain local network monitoring and analysis functions. A user can perform a sequence of network functions, said Dave Couch, test equipment product manager at HP's Colorado Telecommunications Division. "If certain network parameters exceed some preset threshold, a user can change the measurements to further analyze the network and see what nodes are generating traffic or errors."

Rounding out HP's introduction were three software packages that add SNA support to the 4953A protocol analyzer. These include the 18310A SNA emulation language, the 18311A SNA 3270 device exerciser and the 18312A SNA LU6.2 node exerciser.

The software tools also enable users to "twiddle with commands, do boundary-level tests and see where a network fails," Pozzi said. Prices for the three software packages range from $1,000 to $2,500, compared with $7,000 for the 4952A and $2,000 for the 18212A.

COMMUNICATIONS

Data equipment gets bigger budget

From page 51

tion equipment and the remaining 20% to network management control equipment. Compared with 1985, respondents appeared to be spending a smaller percentage of their budgets on transmission products and more on the other two types of equipment, the report stated (see chart page 51).

Responding companies expected to increase installed units of private-line 56K bit/sec. modems by 119% from 1985 to 1987. The report also predicted use of radio frequency microwave equipment, broadband modems and 14.4K bit/sec. modems would grow significantly during the same period.

Private packet-switching equipment is in use at 13% of surveyed firms with more than 5,000 employees and data communications expenditures exceeding $1 million per year, according to the report.

Twenty-six percent of all respondents were using T1 equipment by August of this year, and another 7% anticipate using T1 equipment by 1987. T1 equipment was installed in 50% of the firms with annual data communications budgets of $1 million or greater, the report said.

On a per-unit basis, port selectors are expected to experience a 78% growth during 1986 and 1987, Newton-Evans said. The multiplexer installed base is expected to grow 53% over the 1985 to 1987 period.

PCs get link with TCP/IP

From page 54

packages designed to interface with Netbios can communicate across a Net/One LAN using TCP/IP protocols.

Ungermann-Bass and Excelan, Inc., in conjunction with several other network vendors, are working on a TCP/IP-to-Netbios standard interface so that their respective products can interoperate over a network.

Ungermann-Bass intends to migrate its current and future TCP/IP products to Open Systems Interconnect protocols as they emerge, Burstein said. Conversion will be a matter of loading new software onto the hardware board, he said.

Net/One TCP-PC consists of a board-level Network Interface Unit for an IBM PC or PC AT, plus software that fully conforms with TCP/IP protocols.

Net/One TCP-PC is available immediately, priced at approximately $950 for quantities of 50 or more. An optional programmer's library is priced at $145. An internetwork Name Service is available as a site option. Price varies with network size.

COMMUNICATIONS

Datapoint adds power to LAN

From page 51

stations can access data, peripherals and applications on the Starship II over Arcnet, the vendor's proprietary token-ring network. Arcnet interfaces are standard on all Datapoint workstations and hosts.

A Starship II running RMS/XA has the "power and capacity necessary to support large departmental work groups with a single CPU," said Datapoint Vice-President of Product Development Larry D. Wickwar. The system will compete with IBM's System/38 and the entry-level System 4381, as well as DEC's VAX 8200, 8500 and 8550 and Hewlett-Packard Co.'s 3000 Model 68, 3000 Model 70 and 930, Datapoint said.

Base price for the system, which includes two 80286 microprocessors, 4M bytes of main memory, an I/O channel host adaptor and a dual Arc networking module, is $79,000. Availability is within 90 days, the firm said.

Datapoint also unveiled Starcluster, the new version of its Minx video conferencing and office automation workstation. The 80286-based system supports up to 4M bytes of memory and runs either RMS/XA or Datapoint's DOS operating systems. It features a 14-in. color display with a built-in camera and speakerphone for teleconferencing.

The workstation can participate with other Minx workstations in a videoconference that extends either across a broadband network or from multiple stations on a network out across a remote link to another Minx network, Datapoint said.

Via the Arc network, Starcluster can also run Datapoint's Vista office line of office automation software, providing word processing, electronic mail, spreadsheets and windowing. The diskless workstation can also access applications from a hard disk of an MS-DOS workstation on the network, the firm said. The workstation is priced at $8,900 and is available within 90 days, the firm said.

As part of its integration strategy, Datapoint said it is planning to unveil support of IBM's Distributed Office Support System and to interface with the IBM Token-Ring network, although the firm declined to provide a schedule.

Datapoint also brought out a new disk subsystem for Starship II, providing between 66M bytes and 1.096G bytes of memory. Up to 64 devices can be attached to Starship II providing up to 17.4G bytes of online disk storage, the firm said. Prices for the subsystem range from $19,500 for 274M bytes to $49,500 for 1G byte.

The firm also unveiled a ½-in. tape subsystem that stores data at 1,600 or 6,250 bit/in. The ANSI-compatible unit is priced at $24,500 and will be available in 90 days.

The firm is planning to support Oracle Corp.'s Version V data base management system under RMS/XA and a variety of language compilers, including C, Cobol and its own Databus for Starship II, Wickwar said.

Datapoint, which had for the last two years contented itself with addressing the needs of its installed base, is seeking to broaden its appeal in departmental processing where connectivity is the key ingredient, according to Chief Executive Ed Gistaro.

"With these new products, we're restoring Datapoint as an attack company rather than one working within its own base," he added.

Class costly for Zapmail

From page 51

congressional anger and consternation. The following factors were partially responsible:

- Poor-quality documents with poor-resolution images that were unacceptable for business use.
- Inconvenient locations for dropping off documents.
- Only a limited number of geographic areas served.
- Poor promotion resulting in limited market awareness.

Federal Express purposely provided a feature-rich service designed to avoid all of the above problems. High-resolution graphics would be printed on bond paper. Both pickup and delivery would be provided. More than 100 locations would be served initially. The company's marketing department developed a promotional campaign that included television commercials.

The problem was that Federal Express went too far, investing in a Rolls Royce-quality service when the market could only support a Cadillac. To justify the cost of those top-of-the-line features, the company had to place facsimile machines (Zapmailers) on customer premises. That put Federal Express, a service company, in the hardware business, where it lacked the know-how, culture and focus to succeed.

In the face of hundreds of millions of dollars in losses, Smith announced Sept. 29 the cancellation of Zapmail. It was surely a bitter pill to the great innovator. Federal Express is sure to pursue other electronic communications opportunities in the future, since it offers great profit potential, and the company's long-term success requires that it still view itself as a communications — as opposed to courier — company.

The absence of Federal Express will create a vacuum that a few companies might fill. A prime candidate is DHL Worldwide Express, the largest international courier company. DHL is a leader in delivering documents and small parcels to remote corners of the globe. The company already delivers electronically generated documents and is technologically positioned to address the Zapmail market.

DHL also has a Net Express subsidiary that is developing a high-quality facsimile machine not unlike the erstwhile Zapmailer.

Over the longer term, facsimile will become just one of many methods used to generate and deliver documents. Savvy companies are already exploring the potential of mixing facsimile, text-based electronic mail, voice mail and other technologies in their efforts to address users' changing and growing communications needs.

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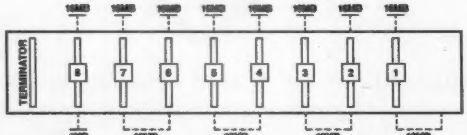

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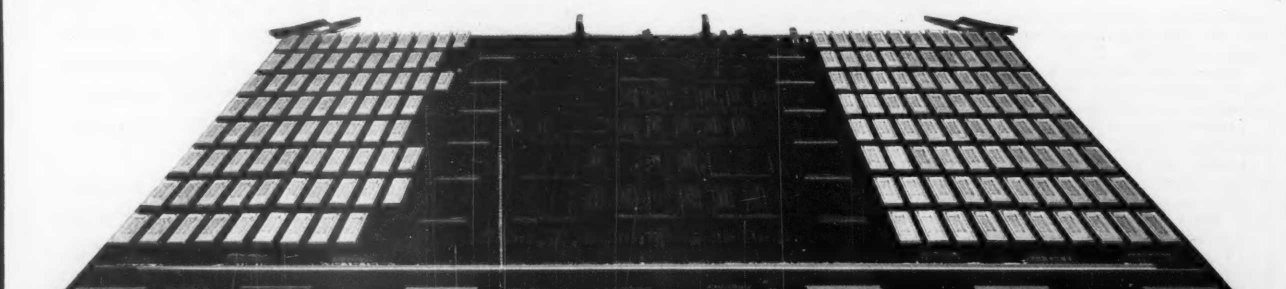

MICROCOMPUTERS

MICRO BITS
William F. Zachmann

NEC PC put through paces

Despite the tremendous success of companies like Nikon, Inc. and Canon, Inc. in cameras, Nissan Motor Co. and Honda Motor Co. in automobiles and Sony Corp. and Panasonic Co. in stereos and televisions in the U.S. market, until now no Japanese vendor has had comparable success in selling desktop personal computers in the U.S. NEC Corp.'s Intel Corp. 80286-based APC IV may be the system that changes all that.

Compatible with the IBM Personal Computer AT and offering a switch selection on the front of the box for 6- or 8-MHz operation, the APC IV is a well-engineered system offering an attractive alternative for users. Although it is not the most aggressively priced system around, it is almost certainly one of the best built, and has the same solid look and feel one associates with Hewlett-Packard Co., Texas Instruments, Inc. and Compaq Computer Corp.

A highly compatible full-function system, the APC IV comes standard with 640K bytes of random-access memory, a clock/calendar, a controller board that will support up to two each of floppy and hard disks, two RS-232 parallel ports and a serial port built in. There are five half-height peripheral slots and eight expansion slots. Two of the latter are 8-bit data bus Personal Computer XT slots; the other six are 16-bit AT slots. Microsoft Corp. MS-DOS 3.1 and GW-Basic also come standard in all configurations.

See **NEC** page 66

Zachmann is vice-president of research at International Data Corp.

Chips up board efficiency

Firm claims kit boosts system power, cuts space

By David Bright

MILPITAS, Calif. — Hoping to speed the development of more powerful personal computers, Chips and Technologies, Inc. has introduced a chip set for manufacturers of Intel Corp. 80386-based IBM Personal Computer AT-compatible systems.

Using the company's seven-chip AT/386 Chipset and its Integrated Peripherals Controller chip, vendors can reportedly build a system board that occupies half the space, consumes one-third the power and produces more than twice the performance of an 80286-based PC AT configuration.

With the smaller size comes a smaller price — product marketing manager Sikander Naqvi says systems using the new chip set will start in price at $4,000. In comparison, Compaq Computer Corp.'s Deskpro 386 starts at $6,499.

Chips and Technologies President Gordon Campbell stressed that systems built with the chip set would maintain compatibility with IBM Personal Computer, Personal Computer XT and AT software. "The AT/386 Chipset provides systems manufacturers with an integrated, cost-effective solution for implementing such high-performance, AT-compatible 32-bit microcomputer systems," he said.

Combined with a 16-MHz 80386 microprocessor, the company is targeting the products at two areas: office automation workstations and extremely high-performance workstations. Optimized for such demanding applications as computer-aided design and engineering, industrial automation and transaction processing, the more powerful systems incorporating the AT/386 Chipset will generally be outfitted with large disk drives, large amounts of random-access memory and extra graphics processing capabilities, Naqvi said.

Some 40 vendors are currently using Chips and Technologies' 80286-related chip set, according to Naqvi. Among those vendors are Tandy Corp., ITT, NEC Information Systems, Inc., mail order house

See **CHIPS** page 65

INSIDE

NEW THIS WEEK

- Cyma/McGraw-Hill offers Cyma Professional Accounting software series
- For more on this and other new products, see pp. 115-143.

INSTANT ANALYSIS

"The cost per millions of instructions per second of the Intel Corp. 80386 system is better than the cost per MIP of the largest, most powerful mainframe today."

— Jon Shirley, president, Microsoft Corp.

Programs offer instant feedback

By Peggy Watt

PORTLAND, Ore. — Airus Corp. recently announced two implementations of its "intuitive" communications system, an approach designed to simplify commands to the operating system and word processing applications.

Both Write Now, a word processing program, and Detente, an accessory to Microsoft Corp. MS-DOS, use Airus-A technology, which the company also licenses as an OEM product. With Airus-A, a user can build customized shortcuts for data entry or take advantage of built-in safeguards that stop screen input if illegal commands are entered, the firm claimed.

Airus promotes its "instant feedback" as the key strength of its tools.

See **PROGRAMS** page 64

Software to run Unix, MS-DOS on 80386 concurrently

By Eddy Goldberg

NEW YORK — Locus Computing Corp. of Santa Monica, Calif., demonstrated an alpha release of its Merge 386 software product, which runs Unix and Microsoft Corp.'s MS-DOS co-resident on an Intel Corp. 80386 processor, at the recent Unix Expo show here.

When completed, Merge 386 will simultaneously and transparently execute both Unix and MS-DOS operating systems, allowing several Unix and MS-DOS programs to be executed concurrently. If successful, it will likely be the first product to support multiple MS-DOS tasks. A beta version of Merge 386 is expected to be ready by

See **SOFTWARE** page 65

Beta users find desktop slide system saves time, money

By Peggy Watt

SUNNYVALE, Calif. — A microcomputer-based slide maker that imprints images directly on film instead of converting on-screen graphics was announced last week by Presentation Technologies, Inc.

The $4,995 Image Maker hardware produces standard slides with up to 16 colors and 400 characters using Presentation Technologies' $295 Image Mate software or any of several other presentation graphics programs running on an IBM Personal Computer or compatible system, according to Alan Nonnenberg, vice-president for marketing and sales.

Target customers are companies that make frequent presentations needing slides or other overhead projections, those that currently use less sophisticated presentation equipment or those companies that pay an outside service agency to produce the slides.

Desktop slide making

"We call it desktop slide making," said Robert Wall, chairman and CEO of Presentation Technologies. "We believe it will make up a new market, a subset of desktop presentations." He also expects the market to grow to $360 million by 1990.

Early customers and beta-test users say the system pays for itself in short order. "It's the difference between doing a nice presentation in one day or going out and spending $25,000 for someone else to do it at the last minute," said Carol Johnston, contracts administrator for Arrow Electronics, Inc. in Sunnyvale and a beta-test user who found the product too useful to relinquish after testing. She uses Polaroid Corp.'s Polachrome film for instant developing.

"It's not really a good idea to decide to do it an hour before the presentation, but the software is very self-explanatory," Johnston added. "The first time I used the Image Maker, I did a presentation of six or seven slides using the free-form design, which is supposed to be the most difficult."

Time saver

Photographic Lab Process Techniques in Sunnyvale found the method saves time without sacrificing quality, according to Alan Lee, company president. "I probably save 80% of my costs," Lee said, who previously sent his computer-designed slide images to an outside agency that converted them to film.

"It's almost optical quality, and that's not true of many computer-generated slides, as far as being crisp and sharp," Lee said. Presentation Technologies said the output is up to 8,000 lines on a slide. Lee said he looks forward to enhancements that allow the immediate merging of photographs with graphics and text on a single slide, a feature Nonnenberg said is in the works.

Ron Brown, marketing communications director at Wyse Technology, Inc. in San Jose, Calif., said Image Maker provides in-house slide production that is sufficient for most presentations. "The resolution stays sharp even when you enlarge the slide," he said.

Typeface variety

An outside agency may have more graphics and typeface variety, but "companies tend to standardize on one look and format anyway," Brown added.

The Image Maker hardware is built around a 35-mm Pentax camera using standard Ektachrome or Polachrome film, which is photographically exposed to images created with overlapping dials, one with characters and the other with colors. The product supports proportional spacing and kerning for text.

Presentation's Wall said two characters are exposed each second, but users said the production speed varies with the design's complexity. "We're trying to appeal to people who don't use slides now because it's not fast enough," Wall said.

Quadram Corp. unpacks an IBM PC-compatible laptop

10-lb unit includes stand-alone processor

By James A. Martin

NORCROSS, Ga. — Quadram Corp.'s Datavue division recently announced a 10-lb IBM Personal Computer-compatible laptop microcomputer consisting of a self-contained laptop module that can work in tandem with a 20M-byte hard disk drive expansion module.

The Snap 1+1, aimed at government, corporate and educational markets, is said to separate into two parts for maximum portability. The module is a self-contained 4½-lb laptop based on a CMOS version of a 16-bit 80C88 microprocessor chip. The chip supplier for the product, however, has yet to be determined.

The laptop portion features 512K of CMOS random-access memory (RAM), an 83-key keyboard, an 80-by 25-line standard LCD screen, a four-hour nickel-cadmium battery and 12V AC adapter and RGB, composite, serial and parallel ports.

The expansion module contains 640K dynamic RAM and is available in dual 3½-in. microfloppy disk drive or 20M-byte hard drive and single 3½-in. disk configurations, both with one half-size expansion card slot. Both weigh about 5 lb and can operate on an internal nickel-cadmium battery for up to eight hours.

Software available for the Microsoft Corp.'s MS-DOS operating system can be stored in the lap module's CMOS RAM for use without the expansion module.

The lap module is "in essence, a diskless microcomputer with great expansion capability," said Sharon Cuppett, Datavue product manager. "With the expansion module's expansion slot, you can put in a bisynchronous communications card or network card and access a mainframe. Together, they offer more options and features in a laptop for less price and weight."

Datavue's latest portable has the potential to appeal to two types of laptop users — those who need a limited-power machine for word processing and note-taking and those who require full functionality when making sales calls or working on the road, according to R. Bruce Johnson, a laptop analyst and manager of the PC Resource Center for Deloitte Haskins & Sells, a New York accounting firm.

"If this can provide a good answer to both, then I think there could be a market for it, despite the glut of laptops out there," he added.

The Snap 1+1 and an optional internal 300/1,200 bit/sec. modem will be available in first-quarter 1987. A basic configuration with dual 3½-in. disks, 640K dynamic RAM on the expansion module and one expansion slot, costs $2,095. A hard-disk version costs $3,495. The lap module can be purchased separately for $1,095.

In addition to the standard LCD screen, amber-colored gaslight and traditional backlit screens will be available, but prices were not announced.

Programs offer instant feedback

From page 61

"Instead of after-the-fact feedback, as with a spelling checker, you can take advantage of the microcomputer's idle time for instant response to input," said Barry Obrand, Airus's president.

Depending on which safeguards are activated, the Airus-A will use reverse text to highlight any apparent spelling error as soon as the first misplaced letter is typed and can immediately offer a menu box of likely alternatives, which change immediately on-screen as a command is entered.

At its extreme, the "Clairvoyance" and "Spell Guard" commands will complete a user's partially typed entry with a word available in the expandable dictionary, said Jay Eisenlohr, vice-president of sales and marketing. Features can also be programmed to prevent the user from completing entry of "impossible" words not in the program dictionary, Eisenlohr said.

The word processing program Write Now follows the simple language commands, including pop-up menus labeled "choices" and "locate" commands for file searches, Eisenlohr said.

Detente is a random-access memory-resident enhancement to MS-DOS and IBM's PC-DOS. Features include a command stack listing the last 10 commands entered and many of the same editing capabilities as Write Now.

"The user has room to grow" by turning on or off various safeguard keys as needed, Obrand said. "If you keep the users too insulated, they can't learn beyond some point," he added.

Though Airus products now run only on IBM Personal Computer and compatible systems, Eisenlohr said the company is interested in product development for the Apple Computer, Inc. Macintosh.

Software to run Unix, MS-DOS

From page 61

year's end, Locus President Gerald Popek said.

Merge 386 provides system integrators with password security and file protection for MS-DOS users; record-level access to the same files by both operating systems; and the ability to invoke Unix programs from within MS-DOS programs.

Locus also demonstrated LX-Windows, a graphics-based MS-DOS/Unix windowing system that will run with Merge 386. LX-Windows, based on MIT's X-Windows, is a graphics-based MS-DOS/Unix windowing system that provides overlapping opaque windows and subwindows to arbitrary depth in the Unix System V environment. It is expected to be released by mid-1987.

For example, when used with Merge 386, LX-Windows will allow a user to sort a large Ashton-Tate Dbase III data base in the background, run Lotus Development Corp.'s 1-2-3 in the foreground and run one or more Unix programs in other windows without interrupting the Dbase and Lotus programs.

Longer term plans at Locus include Microsoft Windows-compatible extensions so that MS-DOS programs enhanced to function in the Windows environment can be supported in the LX-Windows environment.

In a related development, Microport Systems, Inc. of Scotts Valley, Calif., has begun shipping Merge 286, a $199 software package that combines Locus's Multisystem Merge with AT&T's Unix System V to concurrently execute Unix and MS-DOS programs on IBM Personal Computer AT-compatible systems.

According to Chuck Hickey, chairman and chief executive officer of Microport, Merge 286 is the first product to allow simultaneous transparent execution of both Unix and MS-DOS on Intel 80286-based systems.

"The exciting thing we're doing is going after people with ATs who have heard about the power of the 286 but are limited by the 640K-byte barrier," he said.

Merge 286 is sold for $199 bundled with System V/AT, a full adaptation of the AT&T-certified Unix System V/286 for PC ATs and compatibles. Hickey said he has aspirations for Microport to become the "Borland of Unix software," selling its product for a fraction of what competitors charge.

Chips increase board efficiency

From page 61

PC's Ltd. and Multitech Electronics, Inc.

Naqvi suggests there is a good chance that many of those vendors will also use the AT/386 Chipset.

Although only a handful of vendors have announced 80386-based products since the chip was introduced 13 months ago, several system and accelerator board introductions are expected by year's end.

Portable computers reduce operating costs

Federal nutrition plan slashes costs by 30%

By David Bright

CHEYENNE, Wyo. — Despite the Reagan administration's heavy cuts in health and welfare allocations, a federally funded nutrition program in Wyoming has managed to purchase nearly $100,000 worth of portable computer equipment. The investment has paid off, leading to a 30% reduction in operating costs and a sharp increase in the program's overall efficiency.

Prior to purchasing the equipment for its nutritionists, the program relied on handwritten forms, the U.S. Postal Service and mainframe batch processing to handle some 250,000 checks per year.

Wyoming currently has 14 Special Supplemental Food Program for Women, Infants and Children (WIC) project offices serving 33 clinic sites across the state. Participants in the program receive checks made out to food stores for the purchase of dietary essentials such as milk, eggs, fruit juices and baby formula.

Timing crucial

It is crucial to get the food to the participants as soon as possible, but when the program began, it was handicapped by the slow-moving bureaucratic process.

Then, nutritionists filled out multipart forms after interviewing mothers at the clinics. In a labyrinthine process lasting several weeks, the information was then bounced between two mainframes, the state office in Cheyenne and the various clinics. When that process was completed, the state office mailed monthly checks to the clinics.

"The typical turnaround time for all this was sometimes as long as two months," recalls Terry Williams, director of the WIC program. "We had to void a minimum of 15% of the checks, simply because participants had moved or there was a change in their food prescription. Causing more delay, 5% to 8% of the records had errors, because forms had been incorrectly filled out, or had errors in key punching."

Since the program began using Compaq Computer Corp. portable computers in late 1984, however, the turnaround time has been reduced by as much as four weeks, and the checks are printed out at the clinics while the mothers wait. In addition, the need to void checks has been almost eliminated and the nutritionists' accounting time has been cut by 15%, allowing them to handle more participants per day.

Mainframe drain down

The drain on mainframe resources has been reduced by 25%, notes Tony Minnick, vice-president and data processing manager at American National Bank of Cheyenne and planner of the program's computerization.

The original plan called for a computer in each of the project offices. Since the nutrionists would have to travel between the offices and clinic sites, portable computers seemed to be the logical answer, Minnick says.

The Compaq systems were chosen because of their high degree of IBM Personal Computer compatibility, Compaq's solid reputation and the availability of a Cobol compiler for the systems.

In addition, Computerland Corp. was able to provide local service, according to Minnick.

The computerization cost of the program covered 15 Compaq portable computers, five of which are Compaq Plus portables with 10M-byte hard disk drives; the Cobol compilers, written by Microsoft Corp. for IBM; Masterlink Software, Inc.'s Handshake PC-to-mainframe file transfer package; software written by the bank; and 15 Okidata Corp. Microline 92 dot matrix printers.

For connection to the bank's Burroughs Corp. mainframe, all of the computers include Hayes Microcomputer Products, Inc. 1,200 bit/sec. modems.

Except for problems getting support for the Cobol compiler and novice mistakes such as unplugging a system before all the processing had been completed, the transition to portable personal computers was a relatively smooth one, Minnick says.

"We're very pleased at this point," agrees nutritionist Janet Moran, who also helps coordinate the computer operations. When traveling between clinics — which can take as long as nine hours — the nutritionists carry the Compaqs and printers in their pickup trucks. She says the 33-lb weight of the systems is not a drawback, but "if you're carrying one for any distance, it gets heavy."

Immediate corrections

With the Compaqs, the nutritionists are able to enter the data while talking to a participant and correct errors immediately. Each nutritionist leaves his PC on at night with the data communications program running. To save on communications costs, the uploading and downloading of files between the Compaqs and the mainframe begins each day at 2 a.m.

Since the Wyoming WIC program went on-line, a number of IBM PC-compatible laptop computers have come on the market. Weighing only about 12 lb, laptop models from companies like IBM, Toshiba America, Inc. and Zenith Data Systems Corp. would seem to be ideal replacements for the bulkier Compaqs, but no changes are planned, even when additional systems are required.

"Our people are content with what they have right now," Moran says. "They would cut off their right arms before letting anybody take one away."

NEC PC put through paces

From page 61

In Japan, unlike North America and Europe, the de facto standard set by the IBM Personal Computer has played a minor role. Early MS-DOS computers from major Japanese vendors weren't made compatible with the IBM systems.

Earlier versions of the APC, like the Tandy Corp. 2000 and earlier Fujitsu Ltd. systems, eschewed IBM compatibility but included additional graphics capabilities. However, none of these systems sold very well in the U.S.

Nevertheless, the NEC APC developed a good reputation among software developers and began to build a nice following, particularly in computer-aided design and other graphics applications. With the APC IV, NEC now offers a highly compatible system using the Phoenix Software Associates Ltd. ROM BIOS.

Building reputation

With APC IV, NEC continues to build on its strong reputation of offering sophisticated graphics-oriented systems. Although available with IBM Color Graphics Adapter (CGA)-compatible graphics board and monitor, most APC IV sales will be with NEC's Enhanced Graphics Adapter (EGA)- and CGA-compatible Advanced Graphics Board and Advanced Color Display. The latter is identical to NEC's excellent Multisynch color monitor.

The NEC advanced graphics board makes use of the Chips and Technologies, Inc. EGA chip set to provide support for all 17 IBM EGA, CGA and monochrome graphics modes. The Advanced Color Display, which has a claimed maximum 800- by 560-pixel resolution, is more than enough to support the 640- by 400-pixel EGA resolution.

With the ability to expand to 10.5M bytes of random-access memory and a built-in controller for up to two 40M-byte hard disks with a 40-msec access time, the APC IV offers plenty of head room for users needing a big system. It compares favorably with other first-rate products like Compaq Computer Corp.'s Deskpro 286.

Price range

The base unit, with a 1.2M-byte floppy, a 40M-byte hard disk and a keyboard, lists for $3,995. With a 20M-byte hard disk instead, the list price is $3,495. The minimum configuration of the APC IV, with only a 1.2M-byte floppy, carries a price of $2,995.

The advanced graphics package, including the Advanced Color Display and Advanced Graphics Board, lists for $1,325.

These aren't exactly bargain basement prices compared to what the mail-order vendors are offering these days. But they are well below what IBM and Compaq are charging for comparable systems.

Value

For a first-class system from a major vendor, the APC IV offers a good value for the money.

What's more, it is a good bet that it won't be long before NEC offers a high-end Intel 386-based version of the APC as well, making use of ROM wares from Phoenix and silicon from Chips and Technologies.

This would be a complementary offering that could boost the momentum NEC is already developing with the APC IV.

Possible contender

All of which adds up, in my opinion, to a good prospect for NEC to become a real contender in desktop personal computer systems in the North American market.

The APC IV is a high-quality, well-engineered system with lots of capability and expansion potential.

The NEC system offers an attractive alternative to the more established vendors in the marketplace; it also functions as another assurance of continued intense competition among quality vendors.

Disk managers consolidated

By David Bright

NORWOOD, Mass. — Phoenix Software Associates Ltd. recently introduced a software package for managing information on microcomputer hard disk drives. Called Pdisk, the $195 program reportedly improves the performance of IBM Personal Computers, PC XTs, ATs and compatibles.

"Until now, hard-disk users had to rely on a variety of products for disk management," said Mike Olfe, director of programming tools marketing for Phoenix. "Pdisk combines all of these disk management tools in one powerful package that outperforms the others."

Pdisk is a collection of 10 menu-driven utilities, including an advanced backup and restore program; a park utility that shuts down the hard disk drive when the PC is being moved, thereby reducing the possibility of damage and loss of information; a cache utility and six IBM PC-DOS simplification utilities.

The backup and restore function supports any PC-DOS-driven device, including floppy and optical disk drives and nine-track tape drives.

The cache program speeds disk intensive applications by storing commonly used disk information in memory. The operating system simplification utilities enable users to work with files across an entire tree of directories at once.

Stacking storage peripherals aimed at LANs, CAD/CAM

By David Bright

IRVINE, Calif. — With Western Digital Corp.'s recently introduced stacking peripherals, users can interconnect as many as seven storage devices using only one slot inside the IBM Personal Computer.

Called Versastak, the peripheral modules enable users to custom-tailor storage accommodations for such applications as local-area network file serving, computer-aided design and manufacturing, desktop publishing and multiuser computing.

The Versastak line consists of a series of disk, tape and optical storage modules that stack on top of a base unit, which is connected to the host computer. Since they incorporate a built-in Small Computer Systems Interface bus, the modules can link to a variety of systems in addition to the IBM PC. Compatible systems include the Apple Computer, Inc. Macintosh, the Digital Equipment Corp. Microvax and the NCR Corp. Tower.

Adding modules

A key feature of the Versastak modules is that instead of replacing peripherals as the technology advances, more powerful modules can be added to existing modules, explained product line manager Dean South. Each module contains its own controller.

Versastak's $395 base module, which contains a 225-watt power supply, is connected to an IBM PC system via a host adapter board supplied by Western Digital. The board costs $195 for an IBM Personal Computer AT and $150 for a PC XT. The connection between each interlocking module is made by moving one switch. No cables are involved.

Western Digital will offer hard disk drives with formatted capacities of 85M bytes and 170M bytes. The smaller drive features a 30-msec average access time, and the larger drive takes 25 msec to access data. The 85M-byte drive, priced at $2,995, will be available in December. The 170M-byte drive, carrying a price of $3,995, is scheduled for January availability.

The Versastak 60M-byte tape unit operates at 5M bytes per minute in streaming mode. The $1,395 device will be available in December. Plans also call for a 120M-byte tape module to be ready in February.

Western Digital plans to begin shipping its compact disk/read-only memory module in March. Priced at $1,795, each disk can store up to 500M bytes of data. By the second quarter, the company also expects to complete a write once/read many times unit holding as much as 300M bytes.

The company is also developing Intel Corp. 80286 and 80386 file server processor modules for mid-1987 availability, South said.

Versastak is said to be fully compatible with Western Digital's Starlan hardware and can be integrated into Starlan networks. Using Western Digital's Netbios software, the Versastak modules will work with IBM's PC Net and other Netbios-compatible networks.

When used with a PC AT, the Versastak setup can act as a file server storage module for networks from 3Com Corp., Corvus Systems, Inc. and Novell, Inc., according to South.

Software adds photographs to data bases

PHILADELPHIA — Pictureware, Inc. has developed an integrated software system that incorporates photographs into data bases. In a typical application, the program will be used to add photographs to corporate personnel files.

According to Pictureware, its Picturepower program provides sharp resolution and clarity in color or black and white. Operating under IBM PC-DOS, the program contains a data base management system, picture capture facility, picture editor, forms generator and data communications system.

It is also said to be fully compatible with Ashton-Tate's Dbase III Plus package, allowing photographs to be added to existing data bases.

Telephone transmission

With the program's communication utility, photographs and records can be transmitted over telephone lines, direct connections or local-area networks. The company said still-frame video teleconferencing can be accomplished if Picturepower resides on both of the connected workstations.

The black-and-white version of Picturepower retails for $795 and the color version is $995. The video cameras, scanners, video compact disks and other devices for loading the photographs must be obtained separately.

The software also requires a video digitizing board. The picture data bases are stored on disk drives and other devices along with alphanumeric information.

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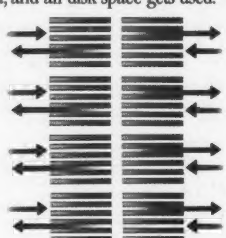

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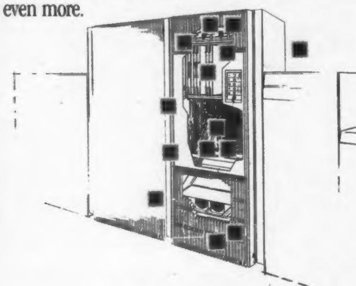

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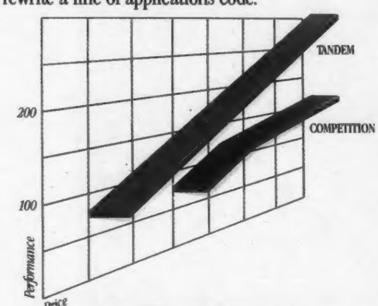

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TANDEMCOMPUTERS

Lotus add-on firms form co-op, target corporate users

HAL developer heads aftermarket group

By Peggy Watt

LOS ANGELES — Lotus Development Corp. 1-2-3 spreadsheet utilities developers and a distributor of 1-2-3 adjunct products have announced they will join forces for a corporate road show and ongoing joint marketing.

"There are possibly millions of Lotus 1-2-3 users out there for whom Lotus is more than a best-selling program. It's a software environment," said Rick Gibson, executive director of The Consortium, Inc., a 4-month-old Los Angeles cooperative.

Many users are unaware of the add-on products and utility programs that could make their work easier, Gibson said, adding that he envisions a $75 million aftermarket for Lotus products in 1987 — many of the products being sold by The Consortium's 17 member companies.

> *'There are possibly millions of Lotus 1-2-3 users out there for whom Lotus is more than a best-selling program. It's a software environment.'*
>
> — Rick Gibson
> The Consortium, Inc.

The Consortium's new business partner is 4-5-6 World, a 2-year-old Santa Barbara, Calif., direct mail and telemarketing firm. Its catalog includes some 300 Lotus add-on products; most of them are software, but some are accessories of general interest to business microcomputer users.

"We believe the Lotus aftermarket is a very strong one," 4-5-6 World President Charles Everett said. He added that 4-5-6 World had $1 million in sales last year and expects to easily double its list of 125,000 subscribers. "There seems to be a great deal of harmony between the goals and operations of our companies," Everett said.

The privately owned businesses will continue to operate separately but will share some officers under the cooperative agreement. Eventually, they may operate out of a single office, Everett said.

Within weeks, the new business partners plan to launch a cross-country corporate tour, demonstrating their Lotus aftermarket products, said Gary Ward, Consortium director of marketing services. He added that his target is users groups, particularly those within corporations.

"We can help users preserve their investment," said Jim Deline, president of Clarity Software Corp., which publishes the error checker Cell/Mate and is a Consortium member. "It seems they just get used to their technology and it changes." Utility programs will help maintain templates, interfaces and methods despite upgrades in the primary product, he added.

Analyst Jan Lewis of the Palo Alto Research Group in California said efforts of The Consortium and 4-5-6 World could actually expand the Lotus market as they enhance it.

"Some people say Lotus users only use a fraction of what's on their desks," she said. "This could change that by making Lotus easier and more accessible."

Paul Gallagher, marketing director of Consumers Software, Inc. in Gilroy, Calif., said the rising profile of the Lotus aftermarket helped him arrange with distributor Ingraham Software of Buffalo, N.Y., to bundle his Lotus utility, a math checker that is called Spreadsheet Auditor, with 1-2-3.

This is The Consortium's Gibson's second venture in the shadow of Lotus 1-2-3. He was one of the officers of GNP Development Corp., which developed HAL, a natural query language for 1-2-3. Lotus bought GNP almost a year ago and recently released HAL under the Lotus label. "Lotus is validating the Lotus aftermarket," Gibson said.

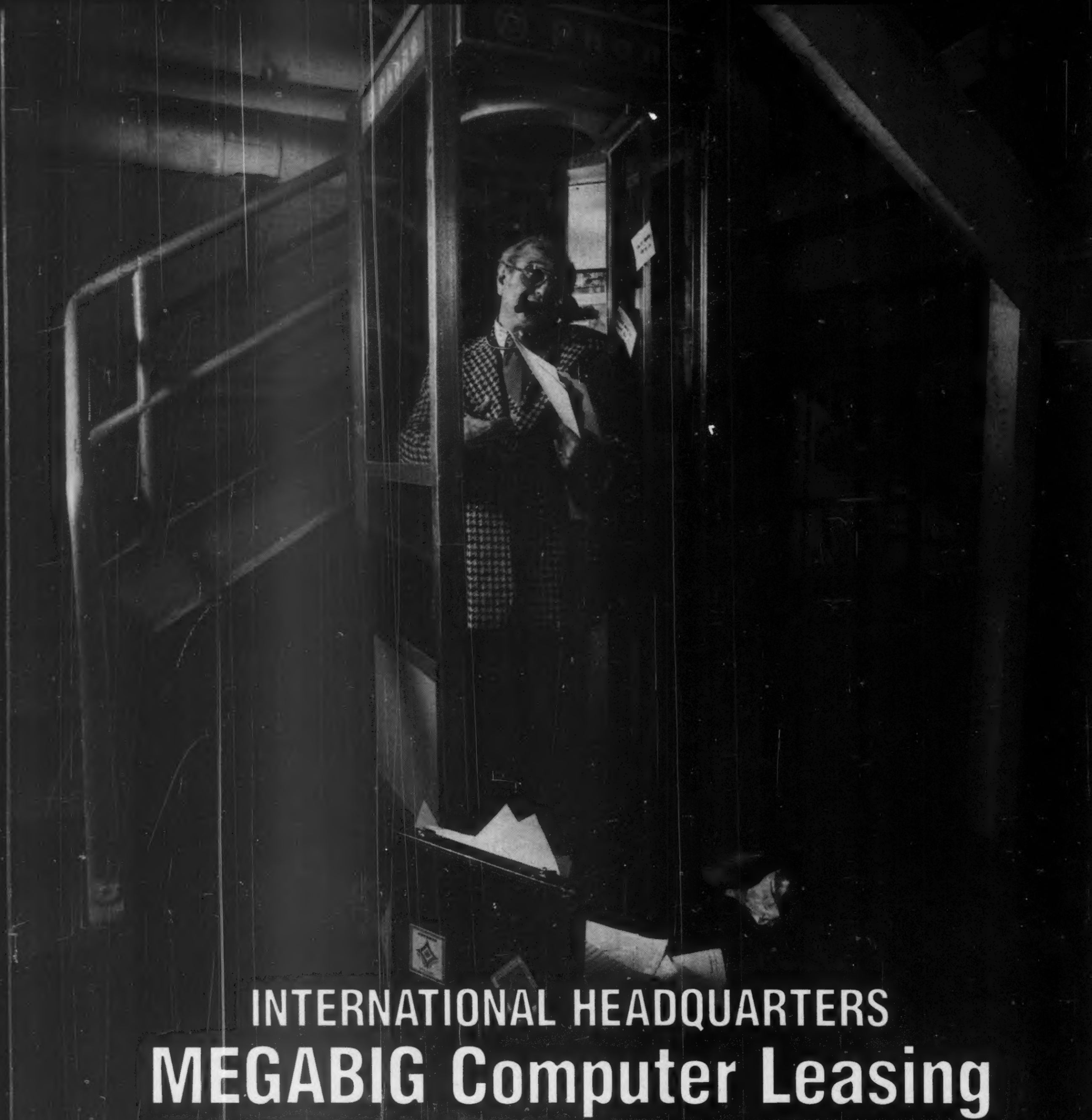
Development service

The Consortium will also expand to offer a development service and market research branch for the Lotus aftermarket, which Gibson said includes 1-2-3, Symphony and Jazz.

The development services will be provided by The Consortium's newest member, the Pasadena, Calif., IBM Users Group, coordinated by Eric Wolfe.

A range of programming services will be offered, including work by specialists in financial investment analysis, micro-to-mainframe communications, data base applications, training and other areas, according to Gibson.

The Consortium's analysis and forecast services will focus on the Lotus market and related products and will include market trends, sales forecasts and studies of various segments of the Lotus aftermarket, Gibson said. Research findings will be free of charge for Consortium members and available to others for a fee.


INTERNATIONAL HEADQUARTERS
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MANAGEMENT

TAKING CHARGE
Eric K. Clemons

Strategic use of info technology

There is now almost total acceptance of the proposition that information technology can provide competitive advantage. There is recognition — after the fact — that information technology has appreciably altered the structure of key industries and enhanced the position of particularly adept competitors.

But important questions remain unanswered, including, How can we predict which industries are ready for major new competitive uses of information technology, providing significant opportunities? And how can we find strategic opportunities within a company?

There will always be opportunities in any organization for improvement in internal efficiencies or in reaching out to customers. In established companies in mature industries, these opportunities are rare and difficult to find. I seek here instead to describe those industries ready for major shifts in the strategic use of information technology.

I assume that, ultimately, markets are efficient and rational. After several years without major changes requiring restructuring or other significant response, available opportunities are recognized and exploited. This is not always true, of course, but options remaining after several years tend to be rare, specific to individual companies and difficult for outsiders to locate and exploit. They are almost always idiosyncratic and thus nearly impossible to predict or describe in any generic way.

See **STRATEGIC** page 85

Clemons is associate professor of decision sciences at the University of Pennsylvania's Wharton School.

Group unites data centers

By David A. Ludlum

HARTFORD, Conn. — The Defense and Space Systems Group (DSS) of United Technologies Corp. has formed a new information management organization aimed at bringing together data centers scattered among the group's operating divisions.

Following a six-month study of data processing and communications by a committee of six senior managers, the corporation last month appointed F. Richard Lennon as vice-president of information management for DSS. Lennon, a former information systems manager, was most recently vice-president of administration for the group's Sikorsky Aircraft division.

F. Richard Lennon

Lennon describes his chief mission as "leveraging" information systems operated by the group's major divisions through standardization and networking, and perhaps consolidation, so that smaller divisions and offices can make greater use of them.

"Each unit has tended to operate relatively autonomously with limited exchange of ideas. I think those days are passed. We're recognizing the need to better use the investments we have in people, hardware and software — to bring units together in more effective critical mass," Lennon said.

The direction is particularly important with the creation of relatively small, space-oriented companies and program offices within the group. "They don't have available to them the resources they need to be competitive," Lennon declared.

While the organization is also aimed at leveraging the group's information systems' buying power by consolidating it, efficiency is not the only concern. The less of its information systems budget the group spends on maintenance — what Lennon terms "mowing the grass and raking the leaves" — the more it has for new technologies that will give it "the real competitive leverage we want to gain," Lennon said.

"We see the power of bringing various units together for various opportunities. If you bring them together as a space company loosely connected by an information

See **GROUP** page 78

Info systems spending rises

By David A. Ludlum

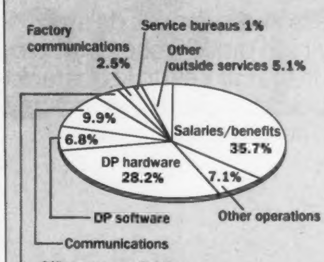
The end of the year will likely see spending on information systems up a relatively modest 8% to 10% from 1985, as companies strive to contain costs and measure return on investments, according to an International Data Corp. study.

The study quantifies trends toward the linking of personal computers, distributed processors and mainframes; networking personal computers; connecting incompatible equipment; and expanding on-line transaction processing.

Information systems spending by sur-

See **INFO** page 88

Information systems spending
Compensation leads U.S. information systems spending in 1Q 1986



Information provided by International Data Corp., 1986

INSIDE

INSTANT ANALYSIS

"There is only a hair-breadth's difference between a genuine competitive coup and a harebrained scheme."
— Warren McFarlan, professor, Harvard Business School

NCR Tower helps Texas drivers move faster overland.

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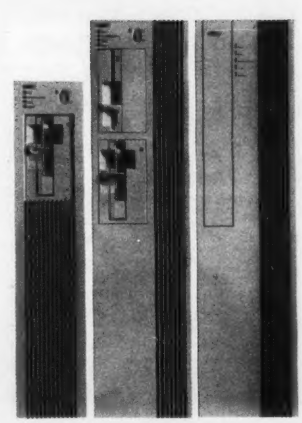
Airborne Express, the overseas delivery service with the sky-high growth record, employs a network of Towers in the Far East to keep track of thousands of international shipments every day.

Obviously, the Tower is a very versatile computer.



Harvard professor cites winners in strategic info systems

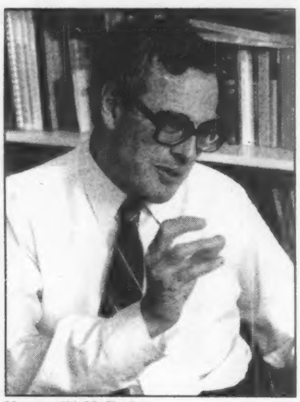
Praises initiative in winning market share

By David A. Ludlum

BOSTON — The capture, maintenance and manipulation of data can make the difference between success and inertia in the realm of strategic information systems, according to Harvard Business School Professor Warren McFarlan.

Initiative and preparation have been crucial to the winning of market share through strategic use of information, McFarlan said in a keynote address at last week's Second Annual Cortex Users Group Meeting. A specialist on information systems at the Business School since 1962 and a member of several corporate boards, McFarlan blended inside knowledge with personal observation in his address.

There has been a conspicuous lack of strategic use of information in the marketing of automobiles — "the largest discretionary, repetitive purchase of American households,"



Harvard's McFarlan

McFarlan said. "I submit to you that one of the genuinely primitive companies in the United States as far as marketing is concerned is General Motors, our largest automotive company," he observed.

McFarlan explained that examination of state registry records would reveal that he buys a car every four to 5½ years. But when he was ready to buy his last car, he received no "focused, direct contact" from automobile companies.

But the mere capture of data does not spell success in the strategic use of information systems, McFarlan suggested. "These focused, customer-oriented systems require an information architecture underneath it, and if you don't have that information architecture you can't, in fact, offer those kinds of services," he said.

Sometimes the value of the architecture cannot be estimated, McFarlan added. "You've got to invest as a matter of faith and flexibility," he maintained.

By contrast, McFarlan offered the example of Northwest Mutual Insurance Co., where he held four life insurance policies. He wanted to know the value of the policies to determine how much money he could borrow against them, but the insurer seemed to deliberately obscure the information in its correspondence.

However, with the arrival of federal tax reform, it became advantageous for Northwest Mutual to lend the money, and it delivered a concise statement of the policy values. That was possible because a relational data base could bring together information pertaining to one customer, McFarlan said.

As another positive example of strategic manipulation of information, McFarlan cited The Travelers Corp., which has provided its sales force with laptop computers. Sales agents enter data on prospective customers in the field and bring it back to their offices, where it is crunched overnight by an expert system with a 6,000-item knowledge base, producing an individual financial plan.

"The notion of cheap, portable intelligence has driven a whole new set of applications," McFarlan said. "[Companies are] driving a much more complex set of tools and analyses out to the point of customer contact . . . allowing salesmen to better tailor to end customers' needs. Those firms that are out there first [will derive] inordinate kinds of advantages."

McFarlan spun his presentation around a list of six types of computer applications that characterize a new generation focused on gaining strategic advantages. They are the following:

- Interorganizational systems that link companies to customers or suppliers, most notably American Airline's Sabre reservations system.
- Expert systems, such as the one used by The Travelers.
- Systems that deliver major cost reductions.
- Those that create a product from data, such as overlooked motor vehicle registrations.
- Management control systems, such as Northwest Mutual's relational data base.
- Systems that redefine industry boundaries, such as Imperial Chemical Industries PLC's personal computer-based order-entry system for farmers.

MIS group relies on comedy, satire to benefit DP illiterates

By Jeffry Beeler

DANVILLE, Calif. — An offbeat professional association that rose to fame in the early 1980s and then died on the vine only a few months later is apparently mounting a serious comeback.

About six years ago, DP consultants Gopal Kapur and George Glaser recognized the need for a light-hearted alternative to the industry's many unremittingly earnest professional societies. With the help of several of their equally prominent colleagues, they formed the International Personhood of Iliterate Programmers (IPIP), which immediately became renowned for its deliberately outrageous gags.

Although their brainchild quickly attracted a large following, the founders lacked the organizational experience to get IPIP off the ground. "When it came to running a professional association, we were illiterate," Kapur quipped during a interview in his office.

Kapur and his associates were particularly stymied by their inability to find a qualified editor in chief for IPIP's proposed newsletter — the "Journal of Iliterate Programmers" (JIP). After struggling with the task for several months, they finally abandoned their search and reluctantly allowed their creation to wither from neglect.

Now, however, the association appears to be experiencing a long-delayed revival. Having recently hired an editor, Kapur is now busily assembling an IPIP board of directors, resuming a drive for prospective members and directing his attorney to register the group as a nonprofit organization.

In its former incarnation, IPIP was distinguished from most other professional associations by its irreverence, impish sense of humor and flagrant disregard for convention. Six years later, the group's love of high jinks remains undimmed. As soon as it gets back on its feet, for example, IPIP hopes to issue each of its members an identification button, which the recipients "will wear under their lapels whenever possible," Kapur said.

The association also plans to hold an annual conference "every 13 or 14 months," he added, and has preserved its intentionally misspelled name.

On the surface, IPIP might strike casual observers as little more than a collection of frivolous pranksters. But beneath its mask of seeming jocularity lies a strong sense of purpose.

Like most other MIS-oriented trade associations, IPIP sees its main role as educational. In particular, the organization aims to promote excellence in the information systems field by highlighting its many problems and working to correct them, Kapur said.

But where most other trade groups project an image of erudition and sobriety, IPIP enthusiastically embraces satire and comedy. A case in point is the society's proposed Digital Disk Award, which will be presented annually to recognize "outstanding stupidity in MIS," Kapur said.

IPIP also plans to sponsor a number of tongue-in-cheek seminars or lectures and will bestow its so-called Freedom Award on developers of programs that run a whole year without any discernible logic errors. As punishment for their exceptional competence, all Freedom Award winners will be required to pay IPIP a token fine, Kapur said.

"Sometimes, satire is a much more effective way of criticizing problems or abuses than seriousness," according to "JIP" editor Len Grzanka. "I expect IPIP to bring a much-needed touch of lightness to a profession that all too often takes itself far too seriously."

Emphasizes practical side

Another feature that differentiates IPIP from many conventional trade associations is its emphasis on the practical rather than theoretical or academic side of information systems, Kapur said. Each issue of "JIP," for example, will include a section called Hindsight, where contributors will explain how they would approach their systems projects differently if they had the jobs to do all over again.

IPIP is predicated on the belief that the systems field's intellectual breadth and rapid pace of change make technological illiteracy all but inevitable. Some illiterates, however, are more technologically unaware than others, IPIP advocates.

Most are characterized by a reluctance to read trade literature, rub elbows with end users or embrace industry standards, Kapur said.

Such employees, because they suffer from the severest form of technological illiteracy, "won't find IPIP the least bit appealing and won't understand its purpose," he added.

Other illiterates, however, are knowledgeable enough at least to recognize their disability and try to overcome it. This latter category of technological illiterates is the group to which IPIP primarily hopes to appeal, Kapur said.

IPIP's annual membership fee is $49.99, and the organization may be reached at P.O. Box 386, Danville, Calif. 94526. Roughly 60% of each fee will go into a scholarship fund for college MIS students.

MANAGERS ON THE MOVE

Fredric F. Perdue has been appointed the **U.S. Internal Revenue Service's** assistant regional commissioner of data processing for the western region, based in San Francisco.

Perdue, 53, will be involved in all aspects of tax return processing, computer services, revenue accounting, public affairs and taxpayer service.

Perdue began his career with the IRS as a revenue officer in 1959 and became a computer programmer the following year.

In 1971 he was chosen for the agency's Executive Selection and Development Program and in 1979 was named director of the returns processing and accounting division in Washington, D.C.

Geoffrey Davis has been appointed vice-president of equities automation for **Pacific Stock Exchange Data Processing, Inc.** in Los Angeles.

Davis will be responsible for directing the automation activities of the exchange's equity trading floors and for reducing costs. He previously worked for First Interstate Services Co., Citicorp TTI and Bank of America.

■

Robert E. Sullivan has been named to the new position of senior vice-president of administration at **Harris Corp.** in Melbourne, Fla.

Sullivan's duties include corporate information and human resource management, corporate relations and legislative affairs.

He previously served as senior vice-president of finance and administration at Harris Graphics Corp. Sullivan also worked for Chrysler Corp. in various financial positions.

Group unites data centers

From page 73

system, you bring a tremendous force to the market," he said.

Such thrusts — including "absorption" of information technology purchased in recent years and a recognition by senior management of the critical nature of information systems — constitute "a whole new mind-set" at United Technologies, Lennon maintained.

DSS's major divisions are Sikorsky Aircraft, a helicopter maker based in Stratford, Conn., and the Norden Systems and Space Transportation Systems divisions, which make products such as rocket components. The group also includes several new program offices, some of which are in Washington, D.C.

The information resources to be harnessed through the organization are extensive and far-flung. Most of the data centers are on the East Coast — in Connecticut, Washington, Alabama and Florida — but there are five in California. Sikorsky and Norden each have four data centers.

The centers range in size from installations of several IBM 3090s or 3084s to those with mid-range IBM 4300 systems and smaller Digital Equipment Corp. VAXs. The hardware is fairly evenly split between multipurpose IBM processors and DEC machines generally used in engineering and manufacturing.

Annual spending

Lennon declined to enumerate the group's annual information systems spending except to say it is in the hundreds of millions of dollars. "We're talking large organization. This is not an [IBM] 4300 shop," he said.

DSS may go to an outside vendor for a turnkey network rather than try to "reinvent the wheel," Lennon said. "We're not facing technological issues. The technology exists to do what we're doing," he observed.

Executives have considered reducing information systems personnel and equipment in pursuit of greater efficiency, Lennon noted. But there also is a recognition that technology will become more important to the company's products.

Lennon reports to William Paul, a United Technologies corporate senior vice-president with responsibility for the entire Defense and Space Systems Group.

Each division or unit has a director of information management reporting to the line managers but with "dotted line" responsibility to Lennon.

MANAGEMENT

CALENDAR

NOVEMBER 9-15

Applied Business Technology Corp.'s 2nd Annual Users Conference. New York, Nov. 9-10 — Contact: Makovsky & Co., 245 Fifth Ave., New York, N.Y. 10016.

Information Industry Association 18th Annual Convention & Exhibition. New York, Nov. 9-12 — Contact: IIA, Suite 800, 555 New Jersey Ave. N.W., Washington, D.C. 20001.

Information Center Implementations: Real Issues. New York, Nov. 10 — Contact: Atre International Consultants, Inc., P.O. Box 727, 16 Elm Place, Rye, N.Y. 10580.

The Information Goldmine. New York, Nov. 10-12 — Contact: Information Industry Association, Suite 800, 555 New Jersey Ave. N.W., Washington, D.C. 20001.

Association for the Development of Computer-Based Instructional Systems Annual Conference. Crystal City, Va., Nov. 10-13 — Contact: ADCIS, Room 409, Miller Hall, Western Washington University, Bellingham, Wash. 98225.

Computers & Management for Contractors Conference & Exposition. San Francisco, Nov. 10-13 — Contact: Irene Nelson, Fleishman & Linden Expositions Group, 2401 Plum Grove Road, Palatine, Ill. 60067.

International Conference on Computer-Aided Design. Santa Clara, Calif., Nov. 10-13 — Contact: IEEE Computer Society, 1730 Massachusetts Ave. N.W., Washington, D.C. 20036.

Comdex/Fall '86. Las Vegas, Nov. 10-14 — Contact: The Interface Group, 300 First Ave., Needham, Mass. 02194.

T-1 and SDN: Seizing Economic Control of the Network. Nov. 11-12, New York — Contact: The Yankee Group, Seminar Division, 14th Floor, 89 Broad St., Boston, Mass. 02110.

Autofact '86 and Sensors '86. Detroit, Nov. 11-14 — Contact: Society of Manufacturing Engineers, P.O. Box 930, One SME Drive, Dearborn, Mich. 48121.

Electronic Demand Publishing. Washington, D.C., Nov. 12-14 — Contact: Gail Montgomery, Conference Registrar, Institute for Graphic Communication, 375 Commonwealth Ave., Boston, Mass. 02115.

National Conference on Building and Operating Defect-Free Software. Orlando, Fla., Nov. 12-14 — Contact: Quality Assurance Institute, 9222 Bay Point Drive, Orlando, Fla. 32819.

NOVEMBER 16-22

ATM9-Electronic Delivery Systems Conference. Los Angeles, Nov. 16-19 — Contact: Bank Administration Institute, 60 Gould Center, Rolling Meadows, Ill. 60008.

S.I. Users Group's 19th Semiannual Conference. Boston, Nov. 16-19 — Contact: Software International, 1 Tech Drive, Andover, Mass. 01810.

Guide 66. Montreal, Nov. 16-21 — Contact: Guide Headquarters, 111 E. Wacker Drive, Chicago, Ill. 60601.

Intermec/Tema's "Winning Edge" Seminar. Natick, Mass., Nov. 17 — Contact: I/T, 19 Erie Drive, Natick, Mass. 01760.

Implementing Low Cost Cadd. Los Angeles, Nov. 17-18 — Contact: National Computer Graphics Association, P.O. Box 3412, McLean, Va. 22103. Also being held Nov. 20-21 in Denver, Feb. 9-10 in St. Louis, Feb. 12-13 in Washington, D.C., April 27-28 in Cleveland, April 30 to May 1 in Chicago, June 8-9 in Detroit and June 11-12 in Boston.

Introduction to Human Resource Information Systems. Seattle, Nov. 17-18 — Contact: Association of Human Resource Systems Professionals, P.O. Box 8040-A202, Walnut Creek, Calif. 94596. Also being held Nov. 20-21 in Houston and Jan. 22-23 in Fort Lauderdale, Fla., and Feb. 9-10 in Anaheim, Calif.

Managing the Strategic Data Planning Project. San Francisco, Nov. 17-19 — Contact: Software Institute of America, Inc., 8 Windsor St., Andover, Mass. 01810. Also being held Dec. 17-19 in Boston.

Strategic Issues in Managing Information Technology: Achieving Significant Improvements in Productivity and Effectiveness. Cambridge, Mass., Nov. 17-19 — Contact: Decision Support Technology, 51 Church St., Boston, Mass. 02116.

Telecommunications Markets: The Impact of IBM. Stamford, Conn., Nov. 17-19 — Contact: Christine Sherman, International Resource Development, Inc., 6 Prowitt St., Norwalk, Conn. 06855.

Thirteenth Annual Computer Security Conference. Atlanta, Nov. 17-19 — Contact: Computer Security Institute, 360 Church St., Northboro, Mass. 01532.

1986 CIPS Conference. Toronto, Nov. 17-20 — Contact: Canadian Information Processing Society, 5th Floor, 243 College St., Toronto, Ont., Canada M5T 2Y1.

Managing the Power of Information. Washington, D.C., Nov. 18 — Contact: Association for Information and Image Management, 1100 Wayne Ave., Silver Spring, Md. 20910.

Marketing, Sales Analysis and Forecasting Using Lotus 1-2-3. Philadelphia, Nov. 18-19 — Contact: Data-Tech Institute, P.O. Box 2429, Clifton, N.J. 07015. Also being held

See **CALENDAR** page 80

MANAGEMENT

CALENDAR from page 79
Dec. 2-3 in Detroit, Dec. 9-10 in New York and Dec. 16-17 in Boston.

Localnet '86, International Open Systems Conference and International ISDN Conference. San Francisco, Nov. 18-20 — Contact: Online International, 989 Avenue of the Americas, New York, N.Y. 10018-5485.

Writing Better Computer Software Documentation for Users. Tempe, Ariz., Nov. 19-20 — Contact: Center for Professional Development, College of Engineering and Applied Sciences, Arizona State University, Tempe, Ariz. 85287.

VMS Performance Management & Capacity Planning Seminar. Cambridge, Mass., Nov.19-21 — Contact: Raxco, Inc., 1370 Piccard Drive, Rockville, Md. 20850. Also being held Jan. 28-30 in Westshore, Fla.

NOVEMBER 23-30

Conference for Artificial Intelligence/Expert Systems. Boston, Nov. 24-25 — Contact: Software Tools Conference, Suffolk University, Boston, Mass. 02108.

Satellite Telecourse on Distributed Processing. Atlanta, Nov. 24-26 — Contact: Association for Media-Based Continuing Education for Engineers, Inc. Satellite Network, 500 Tech Pkwy. N.W., Atlanta, Ga. 30313.

NOV. 30-DEC. 6

Engineering Workstations and the PC. Bedford, Mass., Dec. 1-3 — Contact: Institute for Graphic Communication, 375 Commonwealth Ave., Boston, Mass. 02115.

Optical Fiber Communications. Colorado Springs, Dec. 1-5 — Contact: Continuing Engineering Education, George Washington University, Washington, D.C. 20052.

Information Security: The Challenge. Monte Carlo, Dec. 2-4 — Contact: Marie-Martine Sainflou, Agence de l'Informatique, Tour Fiat-Cedex 16, Paris — La Defense, France.

MAP/TOP Courses. Boston, Dec. 2-4 — Contact: Ship Star Associates, Inc., 36 Woodhill Drive, Newark, Del., 19711. Also being held Dec. 18-19 in Atlanta, Jan. 12-16 in Phoenix, Feb. 19-20 in Orlando, Fla., as well as March 10-12 in Washington, D.C.

DEC: The Next Five Years. San Francisco, Dec. 3-4 — Contact: The Yankee Group, Seminar Division, 14th Floor, 89 Broad St., Boston, Mass. 02110.

Electronic Mail Industry Conference. Dec. 3-4, Washington, D.C. — Contact: EMA, Suite 300, 1919 Pennsylvania Ave. N.W., Washington, D.C. 20006.

Matrix Eight (The Graphic Communications Association's Annual Conference). Fort Lauderdale, Fla., Dec. 3-5 — Contact: Suite 604, 1730 N. Lynn St., Arlington, Va. 22209.

Long Range Information Systems Planning. Philadelphia, Dec. 3-6 — Contact: American Management Association, 135 W. 50th St., New York, N.Y. 10020. Also being held Dec. 8-11 in New York.

The 1986 Computerized Plan Administration Institute. Hollywood, Fla., Dec. 3-6 — Contact: Registrations Department, International Foundation, P.O. Box 69, Brookfield, Wis. 53008.

California Computer Show. Palo Alto, Calif., Dec. 4 — Contact: Norm De Nardi Enterprises, Suite 204, 289 S. San Antonio Road, Los Altos, Calif. 94022.

Software Rapid Prototyping. Dallas, Dec. 4-5 — Contact: EFDPMA Seminars, Dept. SRP, P.O. Box 3608, 3420 Kashiwa St., Torrance, Calif. 90510. Also being held Dec. 11-12 in Anaheim, Calif.

Strategic Planning and Information Systems. New York, Dec. 4-5 — Contact: New York University, School of Continuing Education, Seminar Center, 575 Madison Ave., New York, N.Y. 10022.

DECEMBER 7-13

Software Testing Management Workshops. Jacksonville, Fla., Dec. 7-12 — Contact: Sandra Wasser, Software Quality Engineering, Suite 16, 3015 Hartley Road, Jacksonville, Fla. 32217. Also being held Feb. 15-20 in Orlando, Fla., and March 1-6 in San Diego.

Disaster Recovery/Contingency Planning Seminar. Cleveland, Dec. 8-9 — Contact: ISR Consultants International, Inc., Suite 103, 3455 Washington Drive, Eagan, Minn. 55122.

Financial Microcomputer Conference. Atlanta, Dec. 8-9 — Contact: Richard Yingst, Financial Managers Society, Inc., Suite 2221, 111 E. Wacker Drive, Chicago, Ill. 60601.

Applying Machine Vision to Electronic Component Assembly and Inspection. San Jose, Calif., Dec. 8-10, Contact: SME Special Programs, P.O. Box 930, One SME Drive, Dearborn, Mich. 48121.

The National Connectivity Symposium on Local Area Networks and Micro-Mainframe Links. Washington, D.C., Dec. 8-11 — Contact: Digital Consulting Associates, Inc., 6 Windsor St., Andover, Mass. 01810.

The IBM PC Data Communications Survival Course. Boston, Dec. 9 — Contact: Data-Tech Institute, P.O. Box 2429, Lakeview Plaza, Clifton, N.J. 07015.

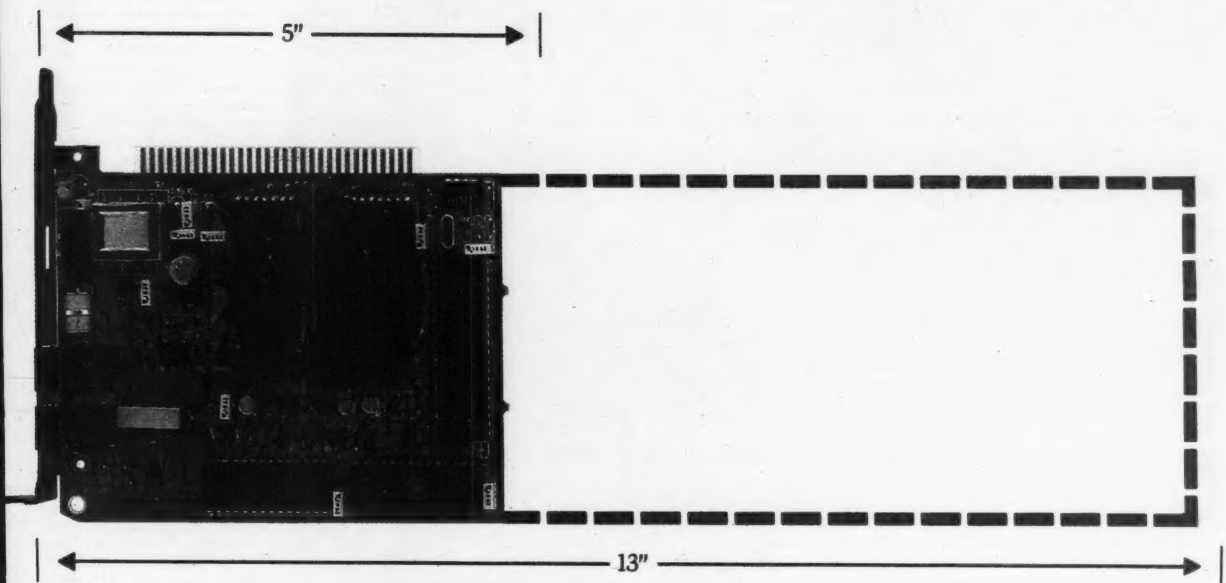
The 4th Computer Symposium for Local Government. St. Cloud, Minn., Dec. 9-10 — Contact: Government Training Service, 202 Minnesota Building, 46 E. Fourth St., St. Paul, Minn. 55101.

How to Design and Implement Bar Code Systems. Clearwater Beach, Fla., Dec. 9-10 — Contact: Nancy Loerch, Society of Manufacturing Engineers, P.O. Box 930, One SME Drive, Dearborn, Mich. 48121.

Managing and Motivating Computer Professionals. Chicago, Dec. 9-11 — Contact: Gary Slaughter Corp., 400 Fifth Ave. S., Naples, Fla. 33940.

See CALENDAR page 82

The largest selling 1200 bps modem just got smaller.



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MANAGEMENT

CALENDAR from page 80

Optical Information Systems '86 Conference. Arlington, Va., Dec. 9-11 — Contact: Conference Management Corp., 200 Connecticut Ave., Norwalk, Conn. 06854.

International Conference on Management and Performance Evaluation of Computer Systems. Las Vegas, Dec. 9-12 — Contact: Computer Measurement Group, 6397 Little River Tnpk., Alexandria, Va. 22312.

1986 CAUSE National Conference. Monterey, Calif., Dec. 9-12 — Contact: Professional Association for Computing and Information Technology in Higher Education, 737 29th St., Boulder, Colo. 80303.

Software Quality Control Management Information System. Boston, Dec. 11 — Contact: James Ettwein, International Datatek, 7 Carriage Drive, Acton, Mass. 01720.

ACE's Third Annual Computer Education Conference. New York, Dec. 13 — Contact: Association of Computer Educators, Inc., 751 Bard Ave., Staten Island, N.Y. 10310.

DECEMBER 14-20

Seventh Annual Data Training Conference and Exposition. Washington, D.C., Dec. 14-18 — Contact: Julia Stasio, Conference Registrar, Weingarten Publications, Inc., 38 Chauncy St., Boston, Mass. 02111.

Advanced Manufacturing Systems-West '87. Anaheim, Calif., Dec. 15-17 — Contact: John Frett or Bill Harrington, Cahners Exposition Group, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, Ill. 60017.

Effective Management Skills for the MIS Manager. Chicago, Dec. 15-18 — Contact: American Management Association, 135 W. 50th St., New York, N.Y. 10020.

Improving Your Internal Consulting Skills. Washington, Dec. 15-18 — Contact: American Management Association, 135 W. 50th St., New York, N.Y. 10020.

Dexpo East 86 Show and Microcomputer Graphics Show. New York, Dec. 17-19 — Contact: Expoconsul International, Inc., 3 Independence Way, Princeton, N.J. 08540.

JANUARY 4-10

Hawaii International Conference on System Sciences. Kailua-Kona, Hawaii, Jan. 6-9 — Contact: Center for Executive Development, College of Business Administration, University of Hawaii, B-101, 2404 Maile Way, Honolulu, Hawaii 96822.

Ten Unix Seminars. Fremont, Calif., Jan.7-10 — Contact: Uni-Ops, P.O. Box 27097, Concord, Calif. 94527.

JANUARY 11-17

Business Automation Forum. Fort Lauderdale, Fla., Jan. 11-14 — Contact: Recognition Technologies Users Association, P.O. Box 2016, Manchester Center, Vt. 05255.

Interfacing Sensors with the IBM PC. Madison, Wis., Jan. 12-14 — Contact: Department of Engineering Professional Development, University of Wisconsin at Madison, 432 N. Lake St., Madison, Wis. 53706.

Winter MAP/TOP Users Group Meeting. Phoenix, Jan. 13-14 — Contact: Society of Manufacturing Engineers, Technical Activities Division, P.O. Box 930, One SME Drive, Dearborn, Mich. 48121.

Computer Graphics '87. San Diego, Jan. 14-16 — Contact: Carol Every, Industry Representative, Frost & Sullivan, Inc., 106 Fulton St., New York, N.Y. 10038.

The Society for Computer Simulation 1987 Multiconference. San Diego, Jan. 14-16 — Contact: SCS, P.O. Box 17900, San Diego, Calif. 92117.

JANUARY 18-24

Pacific Telecommunications Council Ninth Annual Conference. Honolulu, Hawaii, Jan. 18-21 — Contact: PTC '87, Room 308, 1110 University Ave., Honolulu, Hawaii 96826.

Comlease Winter. New Orleans, Jan. 19-23 — Contact: The Information Exchange, 3825-I S. George Mason Drive, Falls Church, Va. 22041.

Buscon-West. Los Angeles, Jan. 20-21 — Contact: The Bus/Board Users Show & Conference, No. 116, 17100 Norwalk Blvd., Cerritos, Calif. 90701.

Uniforum 1987. Washing-

See **CALENDAR** page 90

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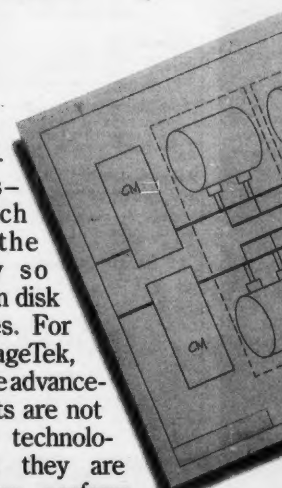

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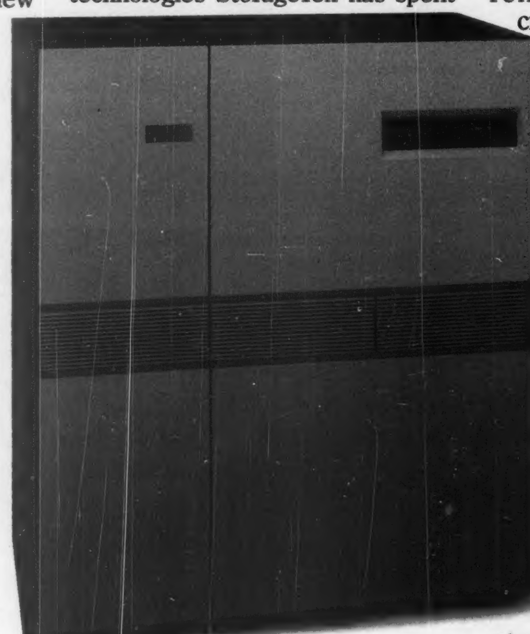

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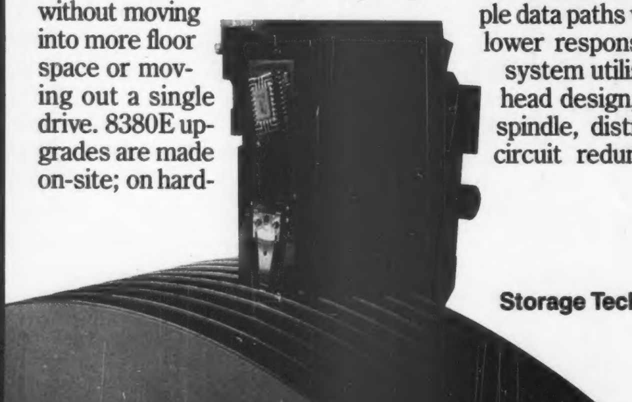

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Strategic use of info tech

From page 73

However, major, disruptive changes may provide opportunities that can be classified and in some sense predicted. Predicting such opportunities is the subject of this column.

Major changes in an industry are invariably followed by periods of turmoil, lags in perception of the changes and lags in understanding their implications. These lags produce delays in competitive response. In turn, this turmoil and its associated delays provide opportunities that an aggressive and innovative insider or a well-positioned outsider can exploit to grab a share of the market. Often, the resulting gains can be sustained.

Probably the most visible form of change disrupting the established patterns and power structure in an industry in the 1980s has been deregulation. An industry may be turned upside down by its own deregulation. Deregulation of airlines has resulted in a rash of airline mergers and failures, the launching and growth of some regional carriers and the collapse of others.

Effect of deregulation

An industry may also face sudden and traumatic shock when a related industry is deregulated. The evolving process of bank deregulation has already affected much of the financial services industry and can be expected to have an even more dramatic effect on insurance companies in the near future.

Of course, deregulation does not instantly alter the ways information technology can be used competitively, nor does it alter which parties are well positioned with regard to competitive application systems. However, by altering the basis of competition, deregulation increases the importance of competitive tools. The airline deregulation of 1978 provides the clearest example.

Computerized reservation systems, especially those used by travel agents, are an effective tool for manipulating distribution channels and influencing ticket sales. Other information systems support rapid, almost real-time planning in the newly competitive environment.

Moreover, deregulation removed protected geographic niches, placing tremendous pressure on regional and commuter airlines. Those regionals with the misfortune of operating out of markets that one of the majors chose to contest found travel agent reservation systems to be an almost irresistible weapon. Perhaps the acquisition or outright failure of many regional and commuter airlines was an inevitable consequence of deregulation's forcing them to compete against carriers that enjoyed vastly superior information technology.

Significant and disruptive change occurs in an industry in only a few other ways. Deregulation, as shown above, can change the structure of an industry, change the balance of power among existing competitors, allow major players to attack competitors outside the industry and allow new competitors to enter from related industries. Expiration of an important patent can have a major effect. Changing customer requirements, preferences or perceptions, if ignored, can produce enormous changes.

Automobile industry

The change in U.S. car buyers' perception of U.S. and Japanese automobile quality, the oil shocks of the 1970s and the cost-consciousness brought about by the concurrent recession combined to do tremendous damage to the U.S. automobile industry when Detroit's response was perceived as inadequate.

The increasing cost-consciousness of corporate travel management is affecting travel agencies and airlines alike. Companies like American Express Co. appear to be benefiting from this change. New competitors can enter the industry.

Changes in the costs or capabilities of technology can create new distribution channels or new products and services with possibilities for influencing customer behavior and wrestling market share away from established dominant players. In turn, these changes not only alter which strategies are effective, they can alter the structure of an apparently mature industry.

See STRATEGIC page 86

Strategic use of info tech

From page 85

All these changes have at least one thing in common — they permit the rapid change of an industry and its major players, creating opportunities for new players with strategies and resources more appropriate for the new conditions.

These changes are particularly disruptive when one or more occur together. The increased skill of Japanese automobile manufacturers was devastating to Detroit because it occurred along with a change in the purchasing patterns of U.S. buyers. I expect that the combined effect of airline deregulation and increased cost pressures on corporate travelers will be evident in the very near future.

Not all changes require a response through information technology. However, almost by definition, a strategically significant change in an industry will require a change in the competitive strategy of its firms or in the implementation of their strategies.

Given its enormous increase in capabilities and its decrease in costs, information technology often provides the appropriate mechanism for delivering these responses.

Where is information technology most likely to be the preferred delivery mechanism for changes in strategy? Application opportunities occur where the special strengths of information technology have always been brought to bear — in dealing with complexity, repetition or transaction volumes and where there is a need for speed.

Thus, complexity of the ordering process may make an order-entry or reservation system an attractive way to manipulate a distribution channel, particularly if deregulation or some other change is altering traditional customer loyalties or purchasing behavior.

Increasing interest rates limit customers' tolerance of loss of float, and competitive pressures similarly increase the need for speed; both explain the profusion of network-based customer services occurring in banking. Uses of information systems occur at all points in the value chain where customers and suppliers face complex interfaces and the need for speed.

Internal support

Internal support uses of information systems are driven by the same three factors as the external systems described above — the need to address complexity, the need for speed and the need to deal with large transaction volumes. For example, after deregulation, airlines used information systems for route planning, to spot market opportunities and to manage the use of reduced fares.

Not all uses of information technology will prove strategic or convey sustainable competitive advantage. These require not only that systems perform as intended but that competitors be unable to duplicate these systems before gains are achieved. First-mover effects — sustainable benefits that accrue to the initial developer or innovator — require that specific combinations of conditions be present in the marketplace.

Barriers to entry — shortages of the necessary skills, absence of a necessary telecommunications infrastructure or the need for an enormous capital expense to develop necessary systems — may exclude some competitors, particularly smaller players. Economies of scale or scope may similarly place smaller players at an irreversible competitive disadvantage. Sustainable advantage has been treated in detail in a previous column [CW, July 28].

In brief, industries appear ready for explosion in the competitive use of information technology when two factors are present. One is that the industry has recently undergone radical, disruptive change, altering its structure, its customers' purchasing patterns and the power of its competitors.

The other is that the nature of current or potential industry practice makes information technology an appropriate way to meet customer and internal needs, generally due to complexity, the need for speed and the presence of repetitive, high-volume transaction processing.

Info systems spending rises

From page 73

veyed companies will average 2.3% of corporate revenue this year, according to the Annual Computer Industry Review and Forecast, published by IDC. That figure compares with about 2% of 1985 revenue reported in the study last year.

Periodic surveys following the study, which was conducted earlier this year among 125 companies that spend an average of $13.1 million on information systems, indicate this year's spending increase is toward the lower end of 8% to 10% of the companies' information systems budgets, according to Tom Elliott, IDC's director of strategic business practices. That compares with last year's projection of 12% growth for 1985, he said.

The most succinct response to a query on the two or three major issues facing information systems managers was, "Costs: managing, containing, justifying," according to IDC's report.

User spending

About a third of information systems spending will be done by user departments, although MIS departments will still be accountable for those expenditures, the study finds.

The report notes that as growth in information systems' budgets slows, equipment spending is increasing more rapidly than that on salaries, which is increasing at about a 5% rate, Elliott said.

The number of information systems workers is growing "considerably more slowly" than in the past, although there are probably more people doing data processing work for user departments, Elliott added.

The area of greatest projected growth in purchases, particularly in large companies, is communications, according to the survey. The survey finds users particularly dissatisfied with current offerings in communications between data center mainframes and distributed processors.

"Incoherent communications" that result from the mix of distributed systems made by IBM and other vendors were a concern at 44% of surveyed sites and combinations of IBM mainframes and non-IBM distributed systems at about 16% of the sites.

IDC sees rapid growth in the linking of personal computers to mainframes or local-area networks (LAN).

While, 60% of personal computers stood alone at the end of 1985, stand-alones will account for only 40% of the PCs by the end of this year, even as the total number of personal computers grows 23%, according to the firm.

LAN linking to double

IDC expects the number of personal computers linked to LANs to double, albeit from a relatively small base, growing from 10% of the total last year to 16% this year.

Links between personal computers and mainframes should grow at nearly as great a rate, from about 33% of personal computers last year to about 50% this year, according to IDC.

The firm reported its first indication that linking personal computers to mainframes might decrease demand for mainframe processing capacity; that trend is expected three times as often by companies using the links as by those not using them.

Another trend, perhaps spurred in part by the growth of micro-to-mainframe links, is the increasing use of on-line transaction processing rather than batch mode.

Asked about the most critical criteria in system selection, more than 80% of respondents mentioned 99.9% uptime. Transaction processing was cited by 60% more respondents than was batch capability.

Other top concerns were data base management and multiprocessing options.

The survey found users of mainframes made by both IBM and the BUNCH companies pleased with the BUNCH machines' operating software, price/performance ratios and on-line performance, but unhappy with the availability of applications software for them.

However, it found these users do not buy as much BUNCH equipment as they do IBM products, in part because they keep BUNCH processors 50% longer than IBM models.

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MANAGEMENT

Multiuser systems key as MIS looks to link stand-alones

By James A. Martin

Due to decreasing costs, the development of the 32-bit microprocessor chip and the growing demands to link end users together, some observers believe small to medium-size multiuser systems will become increasingly important to MIS directors trying to bring conformity to microcomputing chaos.

"The period of 1986 to 1990 will be the time for the MIS director to strike back," says Pauline Alker, president of Counterpoint Corp., a San Jose, Calif.-based multiuser system vendor. "They have been increasingly plagued by this stand-alone microcomputer nightmare and it's time for them to do something about it."

MIS managers have often stood by in frustration, unable to control the proliferation of micros throughout their companies. Often, department managers have purchased stand-alone systems for end users with little consideration of service, support, standards, connectivity or backup, Alker adds.

'Migration path critical'

"A migration path from a single-user environment is becoming critical," says Aaron Goldberg, vice-president of microcomputer services at International Data Corp. in Framingham, Mass. "Multiuser systems can enable a PC to act as a stand-alone device and also be integrated into a shared environment transparently.

"In fact," Goldberg adds, "multiuser systems today have become less the traditional multiuser system and more of a means to provide computing resources to those who don't have it and an integration tool for those who do."

With such features as multiple 32-bit CPUs, enhanced graphics displays, the Unix multiuser operating system and Microsoft Corp.'s MS-DOS and IBM's PC-DOS systems, small to mid-range multiuser systems today can support dozens of users at costs of less than $50,000, Alker says.

Although micro prices have plunged dramatically, the cost per user of a multiuser system can be even less, according to Alker.

"Multiuser systems will not replace PCs in the office, but will coexist with them," Alker says. "That is because the multiuser system can act as a file, network or data base server to a work group and can serve as a front end to the mainframe."

Sales to climb

Microcomputer sales are expected to reach 3.3 million units this year and rise to 4.7 million in 1990, according to IDC. In comparison, sales of multiuser system units that cost less than $50,000 will total 606,494 in 1986 and more than double — to 1.4 million units — by 1990, according to Infocorp statistics.

Although most observers agree that stand-alone processing is losing ground, not everyone believes the smaller multiuser systems will prosper.

"The smaller multiuser sytems are not finding much favor, and there's not a lot of software applications for them," according to Ken Bosomworth, president of International Resource Development, Inc. in Norwalk, Conn.

CALENDAR from page 82

ton, D.C., Jan. 20-23 — Contact: Suite 205, 2400 E. Devon Ave., Des Plaines, Ill. 60018.

Winter 1987 Usenix Technical Conference. Washington, D.C., Jan. 21-23 — Contact: P.O. Box 385, Sunset Beach, Calif. 90742.

JANUARY 25-30

Mapper Installation, Coordination and Support. Dallas, Jan. 26-30 — Contact: Compumetrics Training Institute, P.O. Box 58383, Houston, Texas 77258.

Annual Conference on Improving Productivity in EDP System Development. Phoenix, Jan. 27-30 — Contact: Applied Computer Research, Inc., P.O. Box 9280, Phoenix, Ariz. 85068.

Computer Graphics New York '87. New York, Jan. 28-30 — Contact: Exhibition Marketing & Management, Inc., Suite 690, 8300 Greensboro Drive, McLean, Va. 22102.

Seybold Group Conference on Desktop Communications. San Francisco, Jan.28-31 — Contact: The Seybold Group, Inc., 20695 Western Ave., Torrance, Calif. 90501.

FEBRUARY 1-6

Instructional Computing Conference VII. Orlando, Fla., Feb.2-5 — Contact: Florida Department of Education, Educational Technology Section, Knott Building, Tallahassee, Fla. 32399.

The Third International Conference on Data Engineering. Los Angeles, Feb. 3-5 — Contact: Professor Gio Wiederhold, Stanford University, Computer Science Department, Marguerite Jacks Hall, Palo Alto, Calif. 94305.

COMPUTER INDUSTRY

INDUSTRY INSIGHT
Clinton Wilder

Arbitrageurs in board room?

Notorious arbitrageur Asher B. Edelman has not been seen in computer industry headlines of late, having recently aimed his take-over millions at targets in the trucking and retail grocery businesses. But Edelman's characteristic philosophy — that the sum of a company's parts is greater than its whole — is rapidly replacing the megamerger as the modus operandi of computer industry restructuring.

The Cerberus Group, Inc., a research firm that regularly tracks mergers and acquisitions in the software and services industries, recently noted a sharp decrease in the number of what it calls "megadeals" during the first half of 1986 (see story page 108). Although there are plenty of vendors still out on the acquisition prowl, including Digital Communications Associates, Inc. and Uccel Corp., the really big guns have been silent.

Presumably, the major buyers of the last two years are still digesting their new partners. Restless Electronic Data Systems Corp. (EDS) is still muscling its way into General Motors Corp.'s hierarchy, with EDS Chairman H. Ross Perot insisting, unconvincingly, that he has no designs on the GM chairman's job.

Ameritech and Applied Data Research, Inc. (ADR) seem to be forging closer ties, with Ameritech marketing ace Dennis Strigl recently supplanting admitted techie Marty Goetz as ADR president. And Burroughs Corp.-Sperry Corp. is gradually starting to act like one company, although it has yet to

See **ARBITRAGEURS** page 102

Wilder is Computerworld's *senior editor, computer industry.*

More chip mergers foreseen

Fairchild-Fujitsu deal could be omen for U.S. industry

By James A. Martin

The recently announced merger between U.S. manufacturer Fairchild Semiconductor Corp. and Japan-based Fujitsu Ltd. is expected to be followed by similar consolidations in the recession-riddled U.S. chip industry, analysts say.

"We are going to see more and more alliances between Japanese and U.S. semiconductor manufacturers in the future, due partly to the strength of the Japanese yen compared to American currency," says Andrew S. Rappaport, president of The Technology Research Group, a market research firm in Boston.

"It is becoming harder and harder to manufacture semiconductors profitably in the U.S. and easier to do so in Japan," Rappaport says. "As a result, we've been expecting partnerships to develop where U.S. manufacturers would emphasize product concept and design and Japanese manufacturers would perform the capital-intensive parts, such as manufacturing."

Schlumberger Ltd. of New York said recently it had signed an agreement in principle to merge its Cupertino, Calif.-based Fairchild Semiconductor Corp. with Fujitsu Ltd.'s U.S. semiconductor operations in San Diego [CW, Oct. 27]. Fujitsu will own approximately 80% of the venture and will make a substantial equity investment in Fairchild, according to a joint statement.

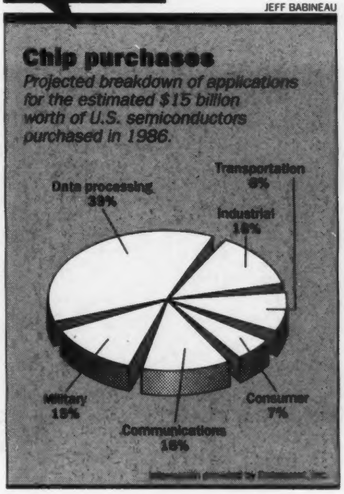
The merger, expected to be complete by the end of the year, allows Fujitsu to leapfrog over its Japanese competitors and should spur similar actions, creating a stronger Japanese presence than is desirable in the U.S. chip industry, according to Steve Szirom, president of HTE Management, Inc. in Scotts Valley, Calif.

"It's ironic," Szirom says, "that Fujitsu and the Japanese have stirred controversy by targeting the U.S. semiconductor indus-

See **MORE** page 101

DATA VIEW

JEFF BABINEAU



Compaq growth slows, but profits up

By Clinton Wilder

HOUSTON — Although its growth rate slowed considerably, Compaq Computer Corp. continued to soar above its microcomputer rivals in the third quarter ended Sept. 30.

Compaq reported that profits rose 39% to $8.7 million, or 28 cents per share, on a 12% increase in sales. In the year-ago quarter, Compaq earned $6.3 million, or 21 cents per share. Revenue in the most recent quarter was $147.2 million, up from $131.7 million last year.

"The company has consistently outperformed the industry, and I didn't see that changing in this quarter," said Bruce Lupatkin, an analyst with Hambrecht & Quist in San Francisco.

Compaq's results were impressive in an industry segment marked by cutthroat competition and deep price cutting. But

See **COMPAQ** page 102

INSIDE

INSTANT ANALYSIS

"IBM strikes us as being in a long-term state of siege by DEC, and continuous price reductions may have to be resorted to in order to forestall too rapid an erosion in market share."

— Frederic Cohen and Walter Winnitzki L. F. Rothschild, Unterberg Towbin

An Wang says entrepreneurial road has become tougher

Reflects on triumphs, errors of 35-year career

By James Connolly

LOWELL, Mass. — There are some things An Wang would do differently if he were starting over today, realizing that one can no longer launch a $2.5 billion company with $500 in savings.

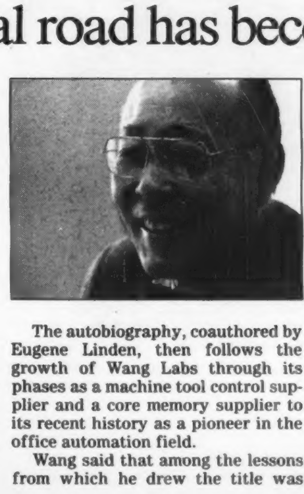
That is the amount of money Wang used to open Wang Laboratories, Inc. in 1951, six years after he fled war-torn China to study at Harvard University. He says that circumstances have changed, making it harder for an entrepreneur to get started when leaving Harvard or any other school today.

"With most of the current entrepreneurs, the first thing they have to do is to call on the venture capitalists to try to bring in a few million dollars to start a business if they don't have it themselves," Wang said in a recent *Computerworld* interview. "You can't advise someone to start with their own $500."

Autobiography

Wang, chairman of Wang Laboratories, made these observations after completing his autobiography, *Lessons*.

The book traces the personal life of Wang, born in Shanghai, from the years of civil war in China and the Japanese invasion during World War II, through his education at Harvard and the days when Wang Labs was a one-man operation in a run-down section of Boston.



The autobiography, coauthored by Eugene Linden, then follows the growth of Wang Labs through its phases as a machine tool control supplier and a core memory supplier to its recent history as a pioneer in the office automation field.

Wang said that among the lessons from which he drew the title was that he should not have ceded even limited control of his venture to outside investors.

He says now that it was unnecessary for him to exchange a 25% interest in Wang Labs for $150,000 in equity investment and loans from Cleveland-based Warner & Swasey Co. in 1959.

Corporate control

Wang said that while Warner & Swasey did not abuse their power, he wanted to keep control of the company within the corporation in which he, his family and close associates are the largest stockholders.

He also regrets having allowed outsiders to market his products and advises managers of growing companies to avoid reliance on such agree-

See **AN** page 108

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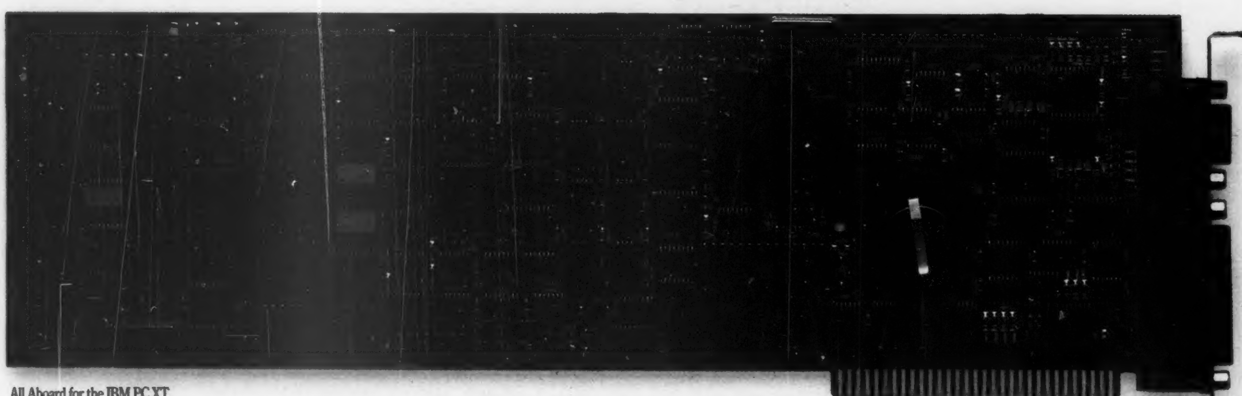
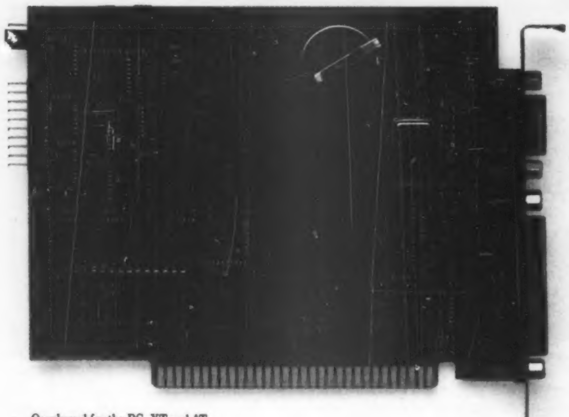


All Aboard for the IBM PC XT.



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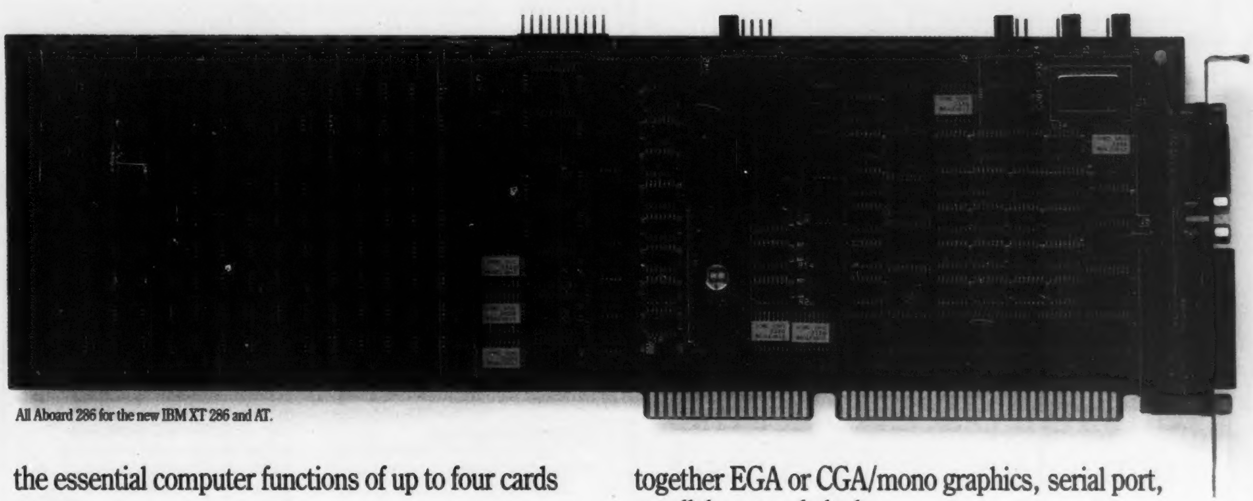

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COMPUTER INDUSTRY

Despite recent gains, Cullinet must prove itself to skeptics

ACTIVE ISSUES
Kathy Porteus

On Oct. 24, shares of Cullinet Software, Inc. (CUL — 8⅝) shot up 24% following weeks of languishing in the $6 range. No new corporate developments caused the jump, which observers attributed to institutional buying. Yet according to analysts, many investors remain skeptical about Cullinet's prospects despite hearing the company outline its turnaround strategy recently.

"Cullinet is a 'show me' stock," says David Readerman, an analyst with Smith Barney, Harris Upham & Co. "Most investors still ask how a company with 29 consecutive up quarters could fall apart so quickly."

During the past year, Cullinet's sales in its core mainframe data base software business suffered weak industry conditions and heightened competition from IBM's DB2 relational data base product, analysts say. Despite sales running 25% below year-earlier levels, Cullinet significantly increased spending on marketing and research and development. Such spending in a time of shrinking revenue led Cullinet's July 1986 quarter $10 million into the red.

Nevertheless, analysts consider this spending necessary for Cullinet's implementation of its new product strategy. Cullinet recently announced migration of its flagship data base product, IDMS/R, to Digital Equipment Corp. hardware platforms. According to Readerman, new directions such as this represent positive product development.

Cullinet also plans to continue building its applications business, which accounted for 19% of corporate revenue last year.

A key to Cullinet's efforts in addressing minicomputer data base software is its recent acquisition of Esvel Co., a San Jose, Calif., software firm that has already developed an SQL-based relational data base management system for DEC's VAX computers.

William Shattuck, software analyst with Montgomery Securities, says that once Cullinet delivers software products for the VAX, its marketing strength will be in supporting and integrating multivendor architectures.

Rick Sherlund, analyst with Goldman Sachs & Co., speculates that Cullinet will also "take some of the truly relational data base capabilities of Esvel's software and fold them into IDMS/R over the next several years."

Because recently announced products are not scheduled for release until fiscal 1988, Cullinet's results for fiscal 1987, ending April 30, will indicate how successful the company is in promoting its new strategy to the corporate market, according to Sherlund. "But now, there is no visibility to improving business conditions for Cullinet," he adds.

Sherlund suggests carefully watching Cullinet's results for its second quarter, which ended last Friday, and its January quarter. He estimates Cullinet will lose 20 cents per share on operations in the October quarter and 60 cents per share in fiscal 1987. "But should Cullinet break even in its third quarter, more investors will probably be willing to speculate in the stock," Sherlund says.

Although not recommending Cullinet, Sherlund says the stock has speculative appeal, but "these guys are far from being out of the woods." Readerman of Smith Barney recommends accumulation of Cullinet stock to long-term, risk-oriented investors.

But Shattuck of Montgomery Securities says investors should buy Cullinet at current depressed prices. He says Cullinet's stock could, within a year, double in value from its recent $6 range, even though a major improvement in current earnings or revenue is not likely until fiscal 1988. "What will help the stock is changing investor expectations of Cullinet getting back on its feet," Shattuck says.

Porteus is president of Strand Research Associates, a Centerville, Mass.-based company that provides customized research services for financial and high-tech firms.

Krowe named to IBM board

By Clinton Wilder

ARMONK, N.Y. — Less than two weeks after placing Senior Vice-President Allen J. Krowe in charge of three of its most critical business units, IBM last week elected Krowe to its board of directors.

Krowe became the fifth senior vice-president on IBM's 21-member board and the first to be named since Jack D. Kuehler last Jan. 28. The others are George B. Beitzel, Nicholas Katzenbach and Dean P. Phypers.

Krowe was given responsibility on Oct. 17 for IBM's Rolm Corp. subsidiary, its personal computers and terminals unit and its mid-range computer and low-end storage divisions.

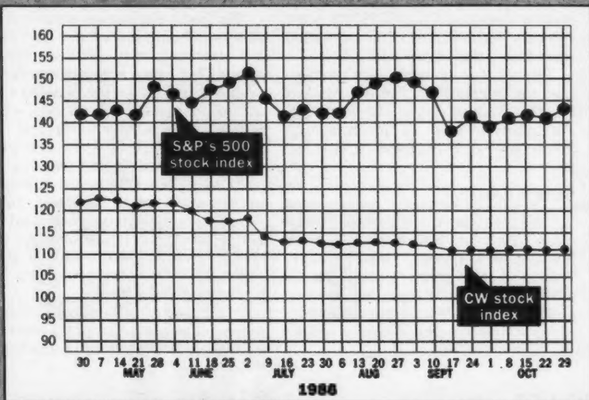
IBM analysts believe the company is depending on Krowe, a dynamic and outgoing executive, to bolster IBM's sales and profits in those areas as its traditionally lucrative mainframe business continues to slow down.

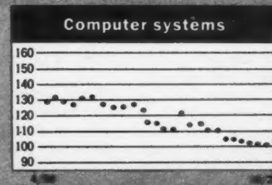
In another move, group executive George H. Conrades became one of 10 IBM senior vice-presidents.

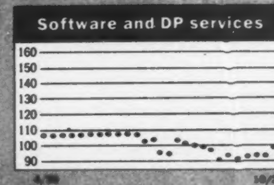
COMPUTER INDUSTRY

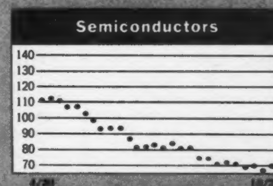
MITCHELL J. HAYES

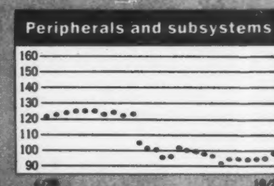
Computerworld stock trading index

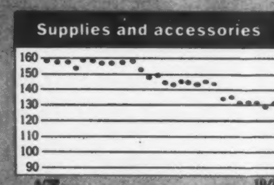












All indexes reflect a historical base of 100 on Dec. 31, 1984, and trace stock market performance in relation to that base. The CW stock index represents the unweighted average performance of the six categories of computer industry stocks.

	10/22/86	10/29/86
Computer systems	103.4	**105.9**
Software and DP services	96.4	**100.6**
Peripherals and subsystems	97.9	**100.1**
Supplies and accessories	130.2	**132.3**
Semiconductors	69.7	**71.4**
Leasing companies	97.5	**96.6**
CW stock index	111.3	**111.7**
Standard and Poor's 500 stock index	141.3	**144.1**

Computerworld stock trading summary

CLOSING PRICES WEDNESDAY, OCTOBER 29, 1986

COMPUTER SYSTEMS

EXCH		PRICE 52-WEEK RANGE (1)		CLOSE OCT 29 1986	WEEK NET CHNGE	WEEK PCT CHNGE
O	ALPHA MICROSYSTEMS	8	4	5.38	+0.1	+2.4
O	ALTOS COMPUTER SYS	19	10	10.38	+0.1	+1.2
A	AMDAHL CORP	22	11	21.75	+2.1	+10.8
O	APOLLO COMPUTER INC	18	9	13.00	+0.0	+0.0
O	APPLE COMPUTER INC	39	18	33.38	+0.9	+2.7
N	AT&T	26	20	24.25	+0.6	+2.6
N	BURROUGHS CORP	78	56	77.75	+6.4	+8.9
O	C P T CORP	7	3	3.38	+0.0	+0.0
N	COMPAQ COMPUTER CORP	18	10	15.38	-0.1	-0.8
A	COMPUTER CONSOLES INC	12	6	9.25	+1.0	+12.1
O	CONCURRENT COMP CORP	25	1	13.50	+0.0	+0.0
N	CONTROL DATA CORP DEL	29	16	27.00	+2.0	+8.0
O	CONVERGENT TECH	14	4	4.63	-0.1	-2.6
N	CRAY RESH INC	100	54	72.88	-3.4	-4.4
O	DAISY SYS CORP	32	8	8.25	+0.5	+6.5
N	DATA GEN CORP	50	25	28.00	+1.5	+5.7
N	DATAPOINT CORP	9	5	8.50	-0.3	-2.9
N	DIGITAL EQUIP CORP	105	56	98.13	+1.3	+1.3
N	ELECTRONIC ASSOC INC	7	4	4.00	-0.3	-5.9
N	FLOATING POINT SYS INC	46	11	10.88	+0.1	+1.2
N	GOULD INC	34	15	19.88	+0.3	+1.3
N	HARRIS CORP DEL	36	24	30.00	+0.8	+2.6
N	HEWLETT PACKARD CO	50	30	39.25	+1.8	+4.7
N	HONEYWELL INC	87	60	71.63	+4.3	+6.3
N	IBM	162	120	120.88	+0.5	+0.4
O	IPL SYS INC	4	1	2.13	+0.1	+6.3
N	ITT CORP	60	33	54.13	+1.6	+3.1
N	M A COM INC	19	12	12.75	-1.6	-11.3
N	MATSUSHITA ELEC INDL LTD	118	55	114.50	+5.5	+5.0
O	MENTOR GRAPHICS CORP	21	11	17.63	+2.6	+17.5
N	MOHAWK DATA SCI CORP	4	1	2.38	+0.0	+0.0
N	NBI INC	14	8	8.25	-0.3	-2.9
N	NCR CORP	57	34	46.00	+1.0	+2.2
N	PRIME COMPUTER INC	28	16	17.00	-0.5	-2.9
N	SPERRY CORP	77	46	75.75	+0.0	+0.0
O	STRATUS COMPUTER	26	17	20.00	+0.3	+1.3
O	SYMBOLICS INC	16	4	4.63	-0.5	-9.8
O	TANDEM COMPUTERS INC	40	16	38.75	+1.3	+3.3
N	TANDY CORP	45	31	38.63	+1.4	+3.7
N	TEXAS INSTRS INC	148	89	110.25	+2.0	+1.8
A	ULTIMATE CORP	35	13	14.63	+0.9	+6.4
A	WANG LABS INC - B	23	11	11.75	+1.3	+11.9
A	WANG LABS INC - C	23	11	11.38	+0.5	+4.6
N	XEROX CORP	72	49	55.00	+0.8	+1.4

SUPPLIES & ACCESSORIES

EXCH		PRICE 52-WEEK RANGE (1)		CLOSE OCT 29 1986	WEEK NET CHNGE	WEEK PCT CHNGE
N	AMER BUSINESS PRODS	37	25	25.88	-0.8	-2.8
N	BARRY WRIGHT CORP	25	15	15.75	+0.5	+3.3
A	DUPLEX PRODS INC	23	18	19.38	+0.1	+0.6
N	ENNIS BUSINESS FORMS INC	28	19	23.38	+0.4	+1.6
N	3M CO	116	77	109.25	+4.1	+3.9
N	MOORE LTD	28	19	21.63	+0.8	+3.6
O	STANDARD REGISTER CO	50	32	32.25	+0.8	+2.4
N	WALLACE COMPUTER SVCS	50	36	39.50	+0.1	+0.3

EXCH: N=NEW YORK; A=AMERICAN; P=PACIFIC; B=BOSTON;
L=NATIONAL; M=MIDWEST; O=OVER-THE-COUNTER; S=SPLIT

O-T-C PRICES ARE BID PRICES AS OF 3 P.M. OR LAST BID
(1) TO NEAREST DOLLAR

SOFTWARE & DP SERVICES

EXCH		PRICE 52-WEEK RANGE (1)		CLOSE OCT 29 1986	WEEK NET CHNGE	WEEK PCT CHNGE
O	ADVANCED COMP TECH	7	4	4.88	+0.0	+0.0
N	ADVANCED SYS INC	19	12	14.13	-0.1	-0.9
N	AGS COMPUTERS INC	25	16	21.75	+2.0	+10.1
O	AMERICAN MGMT SYS INC	20	10	17.75	+1.4	+8.4
O	AMERICAN SOFTWARE INC	15	9	14.50	+1.5	+11.5
N	ANACOMP INC	7	3	3.50	+0.1	+3.7
O	ANALYSTS INTL CORP	10	4	7.00	+1.3	+21.7
O	ASHTON TATE	39	12	36.88	+0.5	+1.4
O	ASK COMPUTER SYS INC	15	9	12.13	+1.1	+10.2
O	ASTRADYNE COMP IND	3	1	1.94	+0.0	+0.0
N	AUTOMATIC DATA PROC	39	27	36.88	+0.1	+0.3
O	COMPUTER ASSOC INTL INC	25	12	22.75	+0.0	+0.0
O	COMPUTER HORIZONS CORP	15	10	10.25	-0.1	-1.2
O	COMPUTER NETWORK TECH	10	2	5.06	+0.7	+15.7
N	COMPUTER SCIENCES CORP	40	27	37.25	+2.0	+5.7
O	COMPUTER TASK GROUP INC	19	11	13.00	+0.4	+3.0
O	COMPUTONE SYS INC	6	0	0.31	-0.1	-16.5
O	COMSHARE INC	16	9	10.50	-0.3	-2.3
N	CULLINET SOFTWARE INC	20	6	8.13	+1.6	+25.0
O	CYCARE SYS INC	17	9	8.75	-0.1	-1.4
O	DUQUESNE SYS INC	33	13	33.00	+1.5	+4.8
N	GENERAL ELEC CO	83	58	76.13	-0.1	-0.2
N	GENERAL MTRS CORP	50	30	35.00	-0.5	-1.4
N	GTE CORP	61	39	60.25	+3.1	+5.5
O	HOGAN SYS INC	12	6	11.63	+0.5	+4.5
O	INFORMATION SCIENCES INC	4	1	1.50	-0.1	-7.7
O	INFOTRON SYS CORP	19	8	11.50	+2.8	+31.4
O	KEANE INC	16	6	5.50	-0.5	-8.3
N	LOGICON INC	43	24	26.13	-0.6	-2.3
O	LOTUS DEV CORP	52	18	50.25	+4.3	+9.2
O	MANAGEMENT SCI AMER	16	9	13.38	+1.4	+11.5
O	MCI COMM CORP	13	6	6.13	-0.9	-12.5
O	MICOM SYS INC	23	10	12.50	+0.5	+4.2
O	MICRO PRO INTL CORP	4	2	2.06	-0.1	-2.9
O	MICROSOFT CORP	40	26	38.50	+0.8	+2.0
O	NATIONAL DATA CORP	26	15	23.63	+2.1	+9.9
O	ON LINE SOFTWARE INT	16	6	10.25	+0.3	+2.5
O	ORACLE SYS CORP	29	13	17.75	+0.0	+0.0
N	PANSOPHIC SYS INC	36	21	30.50	+1.8	+6.1
N	PLANNING RESH CORP	31	14	31.00	+10.8	+53.1
O	POLICY MGMT SYS CORP	24	15	19.75	+2.5	+14.5
O	PROGRAMMING & SYS INC	11	6	8.56	+0.1	+0.7
O	REYNOLDS & REYNOLDS CO	42	20	31.00	-3.3	-9.5
O	SCIENTIFIC COMPUTERS INC	6	4	5.38	+0.6	+13.2
O	SEI CORP	28	15	18.63	-1.4	-6.9
O	SHARED MED SYS CORP	41	29	36.13	+0.4	+1.0
O	SOFTWARE AG SYSTEMS INC	22	14	15.00	+0.3	+1.7
O	SOFTWARE PUBG CORP	10	5	6.38	+0.4	+6.3
A	STERLING SOFTWARE INC	21	9	15.13	+0.8	+5.2
N	UCCEL CORP	26	13	25.25	-0.5	-1.9
N	URS CORP	18	10	17.63	+0.6	+3.7
O	VM SOFTWARE INC	32	17	29.75	-0.3	-0.8

SEMICONDUCTORS

EXCH		PRICE 52-WEEK RANGE (1)		CLOSE OCT 29 1986	WEEK NET CHNGE	WEEK PCT CHNGE
N	ADVANCED MICRO DEV	34	13	14.00	+0.8	+5.7
N	ANALOG DEVICES INC	25	15	17.13	+0.4	+2.2
O	ANALOGIC CORP	16	10	10.38	+0.1	+1.2
N	APPLIED MAGNETICS CORP	20	13	14.75	+0.9	+6.3
O	AVANTEK INC	24	15	16.50	+0.8	+4.8
O	HADCO CORP	7	3	4.00	+0.3	+6.7
O	INTEL CORP	32	16	20.25	+1.0	+5.2
O	MICRO MASK INC	7	2	2.63	-0.3	-8.7
N	MOTOROLA INC	50	31	35.63	+1.8	+5.2
N	NATIONAL SEMICONDUCTOR	16	8	9.25	-0.3	-2.6
N	TERADYNE INC	30	16	16.38	+0.1	+0.8

PERIPHERALS & SUBSYSTEMS

EXCH		PRICE 52-WEEK RANGE (1)		CLOSE OCT 29 1986	WEEK NET CHNGE	WEEK PCT CHNGE
A	AM INTL INC	9	4	6.13	+0.6	+11.4
A	ANDERSON JACOBSON INC	3	2	1.88	-0.1	-6.3
O	AST RESH INC	33	11	11.63	+0.5	+4.5
O	AUTOTROL CORP	10	6	6.75	-0.1	-1.8
O	AVANT GARDE COMPUTING	7	3	4.50	+0.4	+9.1
O	BANCTEC INC	13	6	10.38	+1.4	+15.3
N	BOLT BERANEK & NEWMAN	48	30	41.50	+0.0	+0.0
N	CENTRONICS DATA COMP	8	4	7.00	+0.1	+1.8
A	CETEC CORP	9	5	5.75	+0.1	+2.2
A	COGNITRONICS CORP	6	2	2.50	+0.0	+0.0
N	COMPUGRAPHIC CORP	29	16	19.00	-0.4	-1.9
N	COMPUTERVISION CORP	19	9	15.00	+0.4	+2.6
N	CONRAC CORP	18	12	14.25	+0.0	+0.0
A	DATAPRODUCTS CORP	18	13	13.50	+0.3	+1.9
A	DATARAM CORP	18	6	7.63	+0.1	+1.7
O	DATA SWITCH CORP	9	5	5.50	-0.1	-2.2
O	DATUM INC	7	4	4.38	-0.4	-7.9
N	DECISION INDS CORP	15	8	9.25	+0.4	+4.2
O	ENDATA INC	8	3	6.25	+0.3	+4.2
O	EVANS & SUTHERLAND	27	18	27.00	+2.8	+11.3
N	FLOATING POINT SYS INC	46	11	10.88	+0.1	+1.2
O	GANDALF TECHNOLOGIES	8	5	6.00	+0.4	+6.7
N	GENERAL DATACOMM IND	15	8	8.75	+0.0	+0.0
N	HAZELTINE CORP	30	16	29.63	+9.4	+46.3
O	ICOT CORP	13	7	8.75	-0.1	-1.4
O	INFORMATION INTL INC	18	10	13.75	+0.0	+0.0
O	INTECOM INC	7	3	5.31	+0.0	+0.0
O	INTERLEAF INC	15	8	9.88	+0.0	+0.0
O	MEGADATA CORP	5	2	2.25	+0.0	+0.0
A	MSI DATA CORP	14	8	12.00	+0.5	+4.3
N	NASHUA CORP	28	12	23.25	+0.0	+0.0
O	NETWORK SYS CORP	25	10	11.88	+0.1	+1.1
N	NORTH AMERN PHILIPS CORP	48	33	38.88	+0.1	+0.3
N	NORTHERN TELECOM LTD	38	25	31.25	+2.0	+6.8
O	NOVELL INC	24	13	23.13	+2.9	+14.2
O	OMEX	1	0	0.38	+0.0	+0.0
N	PARADYNE CORP	11	5	4.88	-0.6	-11.4
A	PENRIL CORP	9	5	5.75	-0.1	-2.1
N	PLESSEY PLC	38	19	23.88	-1.4	-5.4
O	PRINTRONIX INC	15	11	12.00	-0.5	-4.0
O	QMS INC	16	8	14.50	+0.4	+2.7
O	RAMTEK CORP	7	3	4.38	-0.3	-5.4
N	RECOGNITION EQUIP INC	17	9	14.50	+2.1	+17.2
N	SANDERS ASSOC INC	63	29	59.88	+0.0	+0.0
O	SCAN TRON CORP	19	10	16.25	-0.3	-1.5
N	SCIENTIFIC ATLANTA INC	15	9	9.25	-0.4	-3.9
O	SEAGATE TECHNOLOGY	19	5	18.13	+0.6	+3.6
N	STORAGE TECHNOLOGY	7	1	2.25	+0.0	+0.0
O	SUN MICROSYSTEM INC	20	11	18.88	+2.5	+15.3
A	T-BAR INC	7	5	7.25	+0.9	+13.7
A	TAB PRODS CO	15	10	13.25	+0.1	+1.0
O	TANDON CORP	8	2	2.00	-0.3	-11.1
A	TEC INC	8	4	4.13	-0.3	-5.7
N	TEKTRONIX INC	67	50	67.00	+3.0	+4.7
O	TELEVIDEO SYS INC	4	2	2.38	-0.1	-5.0
N	TELEX CORP	69	44	62.50	+1.9	+3.1
N	TIMEPLEX INC	24	14	18.25	+0.8	+4.3
N	TITAN CORP	12	6	7.13	-0.6	-8.1
O	VISUAL TECHNOLOGY INC	1	0	0.59	+0.0	+0.0
O	WYSE TECH	19	10	15.38	+0.5	+3.4

LEASING COMPANIES

EXCH		PRICE 52-WEEK RANGE (1)		CLOSE OCT 29 1986	WEEK NET CHNGE	WEEK PCT CHNGE
N	COMDISCO INC	25	12	17.38	+0.8	+4.5
N	CONTINENTAL INFO SYS	12	6	9.00	+0.3	+2.9
O	FINALCO GROUP INC	5	3	3.13	-0.1	-3.8
O	PHOENIX AMERN INC	6	2	4.75	-0.1	-2.6
O	SELECTERM INC	12	5	5.75	-0.6	-8.9
N	U.S. LEASING	46	32	44.25	+1.1	+2.6

COMPUTER INDUSTRY

E-mail firms remodel product lines to find profitable niches

Zapmail's demise dampens optimism

By Elisabeth Horwitt

Following the demise of Federal Express Corp.'s Zapmail service, several electronic mail service companies are revamping their product lines and sales strategies in an attempt to find profitable niches in a sagging market.

"We recently got a call from a customer who said, 'Zapmail is dead, so what's the future for the rest of the business?' " says Thomas Malone, executive director of domestic Telemail services for Telenet Communications Corp., a subsidiary of U.S. Sprint Communications Co.

"We're seeing not exactly a market shakeout, but certainly a retraction," Malone adds.

Analyst forecasts of the generic electronic mail market have lost some of their initial optimism during the last two years. A five-year forecast of the electronic mail market published in 1984 by International Data Corp. subsidiary Link Resources, Inc. predicted that electronic mail service revenue would total $935.5 billion by 1986. In contrast, Link's 1985 forecast estimated 1986 revenues of $450 billion.

Despite, or perhaps because of, this gloomy outlook, companies such as Telenet and General Electric Information Services Co. (GEISCO) have recently refined and even expanded their marketing strategies.

Telenet, for example, has quadrupled its Telemail staff in the past 18 months, Malone says. The company also plans to step up investment in marketing and business areas, he adds.

'Time to invest'

"We feel that the time has finally come to invest, where we had been holding back before," Malone says. Telenet is attempting to capitalize on a broader range of installed communications devices and microcomputers as well as expanded use by white-collar workers, he adds.

For many companies, strategic emphasis is being placed not on "vanilla" electronic mail services, but on specialized areas where firms can leverage existing strengths, such as international communications, electronic document interchange and added-value services such as applications customization and training.

"Few of our clients are interested in electronic mail by itself, but a number want electronic mail and facsimile services internationally," says Jeffrey Held, a group manager at the Fairfax, Va., research company Network Strategies, Inc.

A number of international companies cannot afford to pay exorbitant leased-line costs abroad, according to Held.

PTT prices

"A 9.6K bit/sec. leased-line link from Hong Kong to Tokyo costs about the same as a 56K bit/sec. satellite link from California to Hong Kong — about $20,000. PTTs [Postal Telephone and Telegraph companies] are charging what they can get away with, so it's cheaper to use a vendor's shared service," Held says.

In the increasingly competitive international market, MCI Communications Corp. has at least one special strength: its ability to interface MCI Mail directly with Digital Equipment Corp.'s All-In-1 mail system.

This may be the deciding factor for one of Held's clients, who is currently looking for an electronic mail system to link U.S. headquarters with a branch in Japan, according to Held.

A major strength for GEISCO's international marketing effort is its long-established relations with many foreign PTTs, Held says. "Internationally, success is on a personal level. The PTTs like to work with people they know, so established carriers get things done faster, if not more cheaply," he adds.

Networking costs

MCI and Telenet may be able to control networking costs more effectively than GEISCO, whose extensive leased-line network is vulnerable to carrier rate increases, which have been frequent and dramatic of late. Telenet parent U.S. Sprint's installed base of satellite and ground lines will be a major plus for Telemail in both the international and U.S. markets, Malone says. "It means we can control our own facilities," he says.

"The fact that we are not a carrier does not matter," responds David Page, GEISCO's manager of office services marketing, but he admits that "keeping costs down is a critical competitive factor."

Both GEISCO and Telenet are beginning to offer customization services, tailoring electronic mail applications to each company's networking needs.

GEISCO last week introduced Businesstalk, a commercial version of a product that was originally developed to link Apple Computer, Inc.'s dealer network.

Telenet is broadening its marketing efforts beyond the Fortune 1,500 to the biggest 10,000 companies in specific application niches such as sales, order entry and claims processing, Malone says.

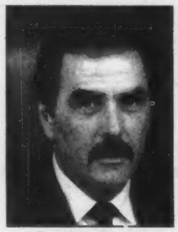
Esprit Systems' metamorphosis keeps terminal vendor alive

By Alan Alper

MELVILLE, N.Y. — During the summer of 1985, few computer industry watchers gave Esprit Systems, Inc. much chance of surviving the year.

The firm was reeling from severe price erosion in its mainstay ASCII terminals business, and its microcomputer division — acquired only a year earlier — was hemorrhaging badly. Esprit, coming off a year when it lost $5.9 million, was in desperate need of refinancing.

But in the year since that point, Esprit has undergone a metamorphosis. The firm bit the bullet by closing its money-draining microcomputer operation. More important, Esprit bit its tongue and accepted $2.4 million in financing from its contract manufacturer, Advanced Datum Information Corp. (ADI) of Taiwan, which purchased 49% of the struggling company.



Esprit's Sasso

"We explored all the alternatives within the industry and, given the shape the company was in, we couldn't raise the money any other way," explains John Sasso, Esprit's president.

Change is nothing new for Sasso. Esprit started out as the computer terminal equipment division of defense contractor Hazeltine Corp. In January 1983, Sasso led a $5 million leveraged buyout of the division's assets after Hazeltine tired of pumping money into the low-profit operation. The company went public later that year, raising $6.1 million.

In mid-1984, Esprit acquired the multiuser microcomputer division of Digilog, Inc. of Montgomeryville, Pa. The diversification move looked good on paper — it positioned Esprit in what appeared to be a growth sector of the industry and provided it with another outlet for its terminals. Yet in reality, it almost cost Sasso the company.

"Right after we made the acquisition, the market started to soften," Sasso painfully recalls. "The terminals business was hard enough to survive without taking on a business in its early stages that required heavy product development and marketing costs. In retrospect, perhaps our money would have been better spent sticking to our own business."

Yet, sticking it out in the highly competitive and price-sensitive terminals business has not been easy, either. In March 1985, Esprit was the first company to match ITT's Qume Corp. $395 no-frills terminal by slashing the price of its own entry-level unit. The result, predicated on Esprit's desire to maintain market share, contributed heavily to its fiscal 1985 losses.

"It's kind of difficult to make money by cutting 20% off the price of a product and not change your cost structure," says Greg Blatnik, an analyst with market research firm Dataquest, Inc. in San Jose, Calif.

While Qume's move helped create a no-frills terminals market segment, neither Qume nor Esprit gained market share. According to Dataquest, Esprit ranked sixth among independent terminals suppliers in 1985, with 45,000 units, or 5%, of the displays shipped in the U.S. The firm's market share slipped from 6.5% the previous year.

"That was not an unusual occurrence in the terminals industry," Blatnick says. "Wyse Technology, Inc. exploded onto the scene, doubling its volume, and left everyone else in the dust." The experience taught Sasso an important lesson. "You don't buy market share in this business, you only rent it," he quips.

Its energy now focused on the terminals business, Esprit is trying a new tack. Esprit's strategy emphasizes support and maintenance as the key ingredients in a prospect's purchase decision, relegating low pricing to secondary status.

Sasso says the emphasis on service and support has helped Esprit regain market presence. For example, its Digital Equipment Corp. VT220-compatible terminal, the ESP 6515, is shipping at 10 times the rate it was last February when the maintenance offer went into effect. "What we've found is that people are willing to pay a premium for value," Sasso says.

Financially, Esprit is gradually rebounding. The firm narrowed its losses for its fiscal year ending May 31, posting a $1.7 million loss, $1.3 million of which resulted from its discontinued microcomputer operation. In its first fiscal quarter of 1987, the firm eked out a $51,000 profit on revenue of $4.9 million, up 10% from the same period last year.

While Esprit is not out of the woods yet, International Data Corp. analyst Dianne Farrell gives the firm credit for persevering. She contends, however, that Esprit must become more innovative to regain lost market share.

"All I see is a company coming out with 'me-too' products," she says. "They need to become more flexible and better meet the needs of customers. Otherwise, they won't grow, but will only maintain themselves."

Ailing chip market forces TI to cut 1,000 jobs worldwide

Layoffs target administrative employees

By James A. Martin

DALLAS — Despite a much-improved third-quarter income of $14 million compared with its 1985 third-quarter loss of $82.8 million, Texas Instruments, Inc. recently announced the elimination of 1,000 jobs worldwide in its ailing semiconductor sector.

The company's semiconductor business, which accounts for about half of its sales, experienced some growth earlier in the year but declined again in the third quarter, according to Stan Victor, company spokesman. The layoffs, the first substantial TI personnel cutbacks this year, will focus primarily on administrative staff and less on production workers, Victor said.

'This move has been aimed at making TI profitable, even if things don't get any better at all.'

— Stuart Johnson
Wertheim and Co.

During the third quarter last year, TI eliminated 2,200 jobs in its Data Systems Group and semiconductor operations as a result of sluggish sales in both sectors. Although TI did not provide details on the number of jobs reduced in each sector, the cutbacks have apparently helped the Data Systems Group, which has operated profitably for three consecutive quarters.

Downsizing its semiconductor business has not been as successful. After showing signs of strength earlier this year, the chip business softened in the third quarter because of continued sluggishness in industrial production, weak capital spending and the declining computer industry shipments.

"What Texas Instruments is doing is certainly in line with what other semiconductor companies are doing," Stuart Johnson, a chip analyst with Wertheim and Co. in New York, said in reference to the layoffs. "Because of the fluctuation this year of the chip market, these companies are left without any clear sense of when there will be some firm improvement. And if they don't know when it's going to end, they have to downsize to function profitably."

With the latest round of job reductions, TI and its semiconductor business should now be positioned to operate in the black, Johnson said. "This move has been aimed at making them profitable, even if things don't get any better at all," he said.

The semiconductor sector's third-quarter results include a one-time charge of $10 million to implement the fourth-quarter layoffs. Excluding that charge, TI's semiconductor business operated slightly below break even for the quarter, the firm said, although it does not provide specific operating results for each division.

Worldwide TI employment shrank from 86,563 to 77,872 in 1985. Following the semiconductor staff cuts and increased hiring in its defense electronics division this year, the company's staff now totals 78,000.

Overall, TI reported third-quarter sales of $1.25 billion, up 5% from $1.19 billion a year ago.

Despite $9M loss, CDC edges its way back toward black

By Clinton Wilder

MINNEAPOLIS — Edging closer to profitability for the first time in almost two years, Control Data Corp. recently reported a loss of $9.3 million, or 23 cents per share, for the third quarter ended Sept. 30.

The results included an operating loss of $1.9 million, compared with an $83.3 million loss from operations in the year-earlier period.

CDC took a nonrecurring loss of $11.4 million during the recent quarter due to divestitures and investment revaluations.

Revenue resulting from CDC's trimmed-down computer business was $818.5 million, 8% less than levels of one year ago.

Although CDC has fought its way back from a severe debt crisis and the worst results in the company's history during the past seven quarters, Chairman and CEO Robert M. Price hinted that the firm will not return to the black until next year.

In a statement, Price said that the "refocusing process" will continue into the fourth quarter.

That could very well mean additional layoffs, probably in computer systems production, according to Michael Hamilton, an analyst with Minneapolis-based Piper, Jaffray & Hopwood.

Hamilton said CDC has done an impressive job of streamlining and downsizing to position itself for recovery, but he said he finds the industry itself is still sluggish.

"1986 is better than 1985 for data storage, but the long-term market prospect is still a question mark," Hamilton said. "And CDC will need some real growth in the mainframe business. They're still walking through some soggy ground."

More chip mergers seen

From page 91

try for growth, and then Fujitsu buys into Fairchild, the company that basically started the U.S. chip industry."

Schlumberger said it would take a $200 million charge in the fourth quarter due to terms of the agreement, apparently less than half of what it paid for Fairchild in 1979.

"Fairchild was a weak sister, and Schlumberger tired of playing sugar daddy," says Michael Gumport, semiconductor analyst with Drexel Burnham Lambert, Inc. in New York. "So they sold out rather cheaply to the Japanese, whose main motivation was to beat the U.S.-Japan trade accords and get a very sweet deal, well below book value." Although analysts perceived the Fairchild-Fujitsu agreement as a sign of further erosion in the U.S. chip industry, such partnerships do not necessarily foretell impending doom.

> *'Fairchild was a weak sister, and Schlumberger tired of playing sugar daddy.'*
> — Michael Gumport, Drexel Burnham Lambert

"If future partnerships are true alliances, they could be positive for the industry," Rappaport says. "But a controlling interest purchased by the Japanese is not as positive as a partnership where the responsibilities are divided up between independent yet cooperating companies. I would hate to see U.S. semiconductor companies be acquired and controlled by Japanese interests."

The Fairchild-Fujitsu company will have a board of directors composed of representatives from both concerns. Donald W. Brooks, president and CEO of Fairchild Semiconductor Corp., will retain that title and duties for the new company.

COMPUTER INDUSTRY

Compaq growth slows, profits up

From page 91

they were below Compaq's own first two quarters of 1986, when profits rose 80% and 70%, respectively.

"There was very slow real unit growth in the U.S. during the quarter until September, when we saw a rather dramatic pickup in Intel Corp. 80286-based products," Lupatkin said. "The high-end strength also showed up in strong sales of the Apple Computer, Inc. Macintosh." Apple recently reported a 47% earnings increase on a 25% gain in sales during the same quarter.

That trend plays right to the strength of Compaq, which has insisted it is fairly immune from the invasion of low-priced Asian IBM Personal Computer clones because of its focus on large corporate users seeking top-of-the-line micros with superior service and support.

However, Compaq's overall market share has been eroding in the retail dealer market, which is its sole distribution channel. Compaq's dollar market share fell from 13% in July to its lowest level of the year of 9% in August, according to the monthly dealer survey by Infocorp, a Cupertino, Calif., market research firm.

During the third quarter, Compaq introduced the Deskpro 386, a much-heralded 32-bit micro based on the Intel 80386 chip. Lupatkin predicted that Compaq will ship between 20,000 and 25,000 units of the model before the end of the year.

Arbitrageurs in the board room?

From page 91

figure out a name or a corporate headquarters site.

The merger and acquisition action has shifted, for the most part, to the bits and pieces approach. In every industry segment, major vendors are shedding, divesting and spinning off business units that don't fit, don't make money or would just appear to be better off on their own.

The list is a long one, including Burroughs' Memorex Corp. subsidiary; Control Data Corp.'s Commercial Credit Co.; Sperry's Aerospace and Marine Division; and, among the most extreme examples, Norcross, Ga.-based Intelligent Systems Corp.

Intelligent Systems, which basically grew by acquiring various microcomputer-related companies, last month announced a complete reversal of course. It put itself up for sale, most likely via a piecemeal sell-off of its various business units.

The bottom line in this unusual approach is fairly simple. The day after Intelligent Systems announced it was out to woo suitors, its stock price jumped about 35%. Intelligent Systems executives say they are trying to cut the best deal for their shareholders, and the latter evidently agree.

More and more, purely financial considerations seem to be the motivating force behind computer industry wheeling and dealing. Admittedly, no one but the most naive observer would think that such motivations are ever absent from corporate strategy decisions.

Nonetheless, why does it seem like an increasing number of vendor executives look at their companies from the same perspective as investment bankers? And where does that leave their customers?

Although it has been almost two years since Asher Edelman's last assault in the computer industry with Datapoint Corp., his ideas about where value lies in vendor companies are alive and well. Last week, Intelligent Systems' micro-to-mainframe unit, most likely the first of Intelligent Systems' stable to go to the auction block, edged closer to a sell-off in highly secretive negotiations. Its name, by ironic coincidence, is Asher Technologies, Inc.

Learn to profit from customized software contract mistakes

OUTSIDE LINES
Alonzo D. Saunders

A recent opinion in the case of *Whelan* v. *Jaslow* breaks new ground by allowing copyright protection for the structure and sequence of a computer program. Copyright protection previously existed only for a program's source and object codes; that is, the literal codes. The *Whelan* v. *Jaslow* opinion is comprehensive and will likely be followed by other courts across the country.

The facts of the case are all too familiar. A dental laboratory hired an independent software consultant to write a customized program to handle the lab's various business tasks: bookkeeping, inventory, updating of customer lists, invoicing, billing and the like. The software developer wrote the program, delivered it to the dental lab and later discovered the lab was itself marketing a competing business application.

The developer sued the lab for copyright infringement and unfair competition and won. The Federal Appeals Court found that, although the lab's program was not a direct transliteration of the developer's program and was written in a different language, the program was "substantially similar" because its structure and overall organization were virtually the same. The court granted an injunction against further sale of the package and awarded damages to the developer.

What saved the developer was his valid copyright. A safeguard against unknown factors is to make sure filing procedures for the copyright are in place, including filing without delay. There is little doubt that had the developer delayed filing, or had the lab filed for copyright first, the result would have been the opposite, given the similarity between the two programs.

Ordinarily, one would not expect a dental lab to be able to get into the software development business but, in this case, the lab did. Developers should structure their agreements with purchasers to close this back door.

Technology makes new markets, and there is an interplay of market and technology here. The broad market was the dental lab market, but there were at least two submarkets: those labs that could use programs written in Basic and those labs that could use programs written in EDL.

The court did not make the distinction between the two submarkets, probably because the programs were so similar. But what if the lab had written a noninfringing program? The lab might have had the Basic user market to itself, plus the royalty from the EDL market the developer gave it. When making agreements, developers should keep an eye on potential submarkets and factor in the probability of change.

A related consideration involves enhancements. Many firms that buy customized software want to enhance their purchase over time as they acquire new equipment or upgrade the equipment they have. If the purchaser wants to make enhancements, what should the developer's posture be?

A smart developer will want to keep his business and should stay in close touch with his former customers. The developer will usually require enhancement information to be given back to him first. If, after review, the developer does not want the information, he can exercise a right of first refusal and the enhancements go to the customer.

The agreements between the parties should devise a procedure spelling out ownership of enhancements that ultimately may be found infringing by a court in case of litigation.

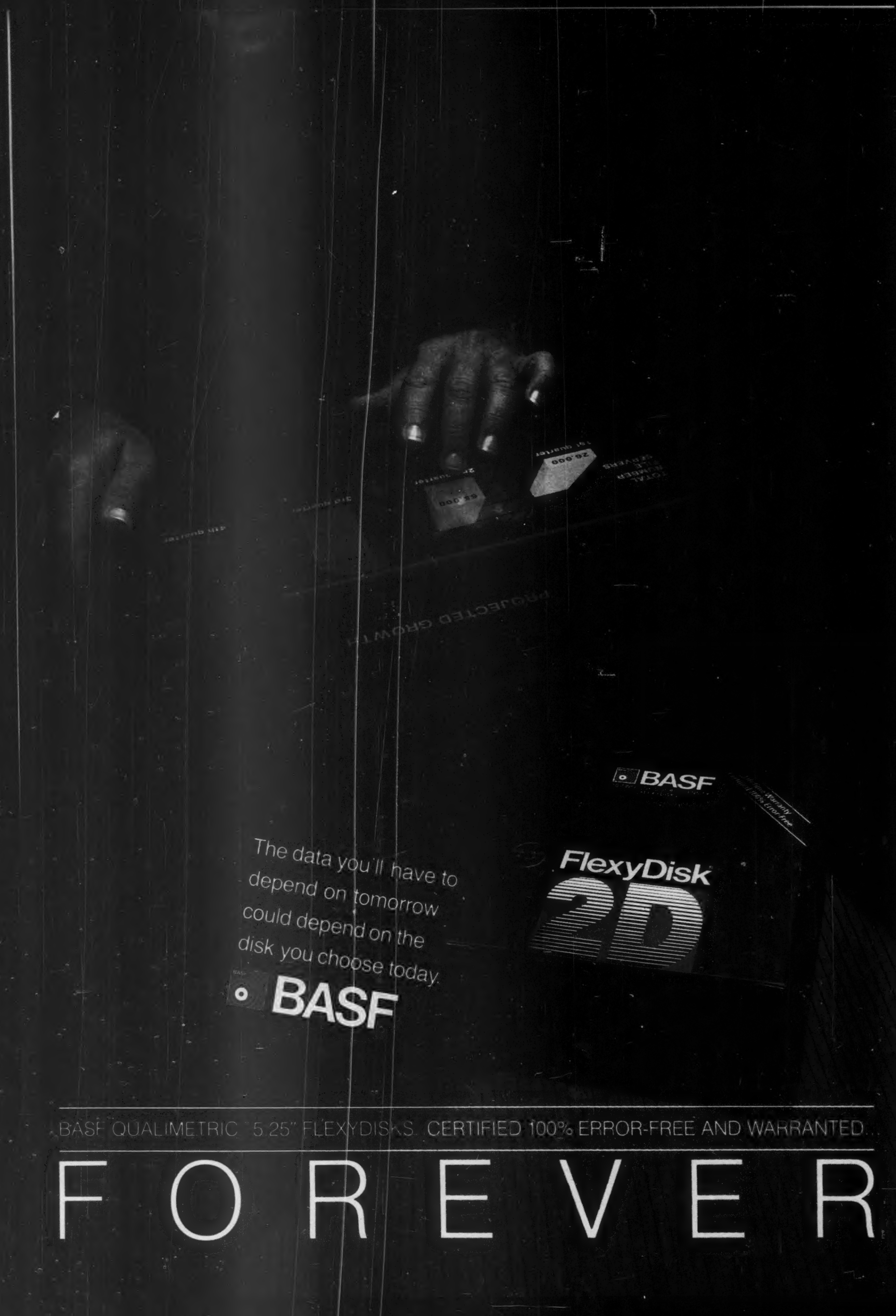
Developers must also consider the interplay of the people involved. People and companies rapidly come and go in this business.

In *Whelan* v. *Jaslow*, the developer left the company where he once worked and took the lab business with him to form a new company, which became the plaintiff. Unless there in a strong covenant between the developer and the former firm not to compete, you can bet that the old firm will be eyeballing the fine print to cash in on the ex-employee's good fortune.

One last consideration. The complexities of technology, the fluidity of markets, the revolving door of personnel and greed all suggest that no customized software contract should be written without a clause for dispute resolution. Oddly, no such clause existed in this case.

Whelan v. *Jaslow* achieved a balance with respect to the Copyright Act as it affects software developers. Both parties in the litigation made mistakes but, through this opinion, other developers may learn how to profit from those mistakes. The real virtue of the case lies in outlining the road map of practical considerations for those responsible for structuring customized software contracts.

Saunders is a Boston-based attorney whose practice includes corporate and international law.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CDC coordinates R&D to achieve corporatewide benefits

Business units to share technology advances

By Clinton Wilder

As Control Data Corp. anticipates reporting its first quarterly operating profit since fourth-quarter 1984, the company's favorite buzzword for its recovery has been "refocusing."

The phrase is often associated with layoffs and divestitures, but it has also been the theme of CDC's research and development, according to Robert M. White, CDC's chief technical officer and vice-president of research and engineering.

Two months ago, CDC established a corporate research and engineering office under White's direction to coordinate all of the company's research and development efforts. The office's goal is to better organize R&D so research advances may be shared by CDC's four major business units — data storage, computer systems, government systems and ETA Systems, Inc. supercomputers.

In order to focus the efforts, CDC has identified four of what White calls "corporate critical" technologies — electronic computer-aided design, software, semiconductor packaging and artificial intelligence. "We have realized that these technologies span across all areas of our business," White said in an interview last week.

One example of shared technology is in AI, where CDC is attempting to develop generic shells for expert systems that can be customized to the R&D needs of each business unit. At this point, most of the efforts in AI and the other technologies are targeted at internal use as development aids, not marketable products.

CDC is also banking on a major contribution to its research efforts from Microelectronics and Computer Technology Corp. (MCC), the much-publicized consortium of U.S. high-tech firms pooling R&D efforts. CDC Chairman Emeritus William C. Norris was a driving force behind the formation of MCC, and CDC, perhaps more than any other MCC member, considers MCC research critical to its own success.

CDC's Robert White

The four technology areas identified by CDC are also subjects of individual research programs at the Austin, Texas-based MCC. White's office is responsible for coordinating research advances at MCC with CDC's internal R&D.

White denied that the recent resignation of MCC chief Bobby R. Inman [CW, Sept. 8] leaves a leadership void that will damage the consortium's progress. "Inman did a super job building MCC up from nothing, but his was very much an outward focus," White declared. "He was very visible, and great public relations were what was needed in the beginning. But now strong management, not technology transfer, is the big challenge."

Within CDC, White said that the firm has been able to maintain its annual R&D budget at about $400 million per year. The firm's refocusing, he said, has been on its technology-intensive products.

"We need to convince employees and customers that Control Data is committed to technology," White said. "Under [Chairman] Bob Price, the company has been getting rid of its nontechnical businesses. With ETA, for example, we're targeting the highest performance end of the business — customers who need more power than IBM can offer," he added.

DEC charged in $6M lawsuit

By James A. Martin

ATLANTA — An Atlanta-based computer and software marketing company has filed a $6 million lawsuit against Digital Equipment Corp. alleging that DEC failed to correct programming bugs discovered in DEC software.

The lawsuit, filed in U.S. District Court by Atlanta Software Consultants Organization, Inc. (ASCO), seeks $1 million in actual damages and at least $5 million in punitive rewards. The suit claims that between October 1982 and August 1985, DEC did not correct programming errors ASCO discovered in DEC's DIBS-11 Order Entry/Inventory Management software program.

In addition, the suit charges that DEC reneged on a promise to establish a special telephone response line to handle processing problems resulting from the software and that ASCO incurred great expense in its attempts to appease its customers.

A spokesman for DEC said the company had not seen the lawsuit and would not comment. Officials at ASCO could not be reached for comment.

An Wang reflects

From page 91

ments. He said that in 35 years he only twice feared going out of business. The first was during the initial, tentative year of operations, and the second was when Compugraphic Corp. canceled an agreement to sell a Wang-built typesetting system called Linosec.

"The worst time I can remember is May of 1964," he said. "We had just broken $1 million in sales, and everybody was saying that once you get to $1 million in sales the company is safe. A million dollars was big business in 1964.

"Well, half of those sales were to Compugraphic for the Linosec. Right after that they came back and said they had already sold 70 or 80 of these and they decided to build them themselves. So, they no longer needed us to build it for them, and we lost two thirds of the next year's business," Wang said.

Several chapters of Wang's book focus on his competition with IBM, including Wang Labs' attempt to steal the office automation market from IBM with the introduction of word processors and IBM's earlier purchase of core memory patents from Wang. Wang said he is suspicious of some of IBM's actions surrounding the negotiations and another inventor's legal action in connection with the core memory patents in the mid-1950s.

IBM eventually purchased the patents for $500,000 in 1956 but retained $100,000 of that because of the litigation. He said some of his suspicions dealt with whether IBM had a closer relationship with the other inventor than it claimed.

Now 66, Wang says he has no plans or desire to retire. He also disputes reports that his relinquishing of the title of company president in 1982 was a step toward retirement.

Wang, who subsequently reclaimed that title when the previous president, John Cunningham, left the company in 1985, says that the day-to-day duties he surrendered to Cunningham were primarily marketing duties. He maintains that he kept control of research, development and manufacturing.

Megadeal activity declines in first half of '86, report says

By Alan Alper

FRENCHTOWN, N.J. — The total value of acquisitions and mergers in the information processing industry plummeted by 12% to $1.87 billion during the first half of 1986, a result of the decline of so-called "megadeals," according to merger specialist the Cerberus Group, Inc.

In its recently released report, the firm noted that the number of megadeals — defined as acquisitions or mergers with a value exceeding $100 million — dropped to just five in the first half of 1986, accounting for 74% or $1.4 billion of the total value of transactions during the period.

During the first half of 1985, when a record-setting $2.1 billion worth of acquisitions and mergers occurred, there were "about eight" megadeals, noted Charles Varga, Cerberus Group chairman.

There are a variety of reasons for the decline, Varga said. "A number of companies rushed to complete deals late last year. Also, what we may be seeing is a cyclical slowdown. The stock market has been wasteland for many software and services companies, which has hurt valuations."

Despite the slowdown in acquisition activity, Varga said some information processing firms are scouring for transactions that refocus objectives to core-related business either through the divestiture of nonstrategic business units and product lines or acquisitions that jibe with the corporate strategy. The cash raised is being used to retire debt, finance other strategic acquisitions and stock repurchase plans, he added.

While acquisition-minded firms are becoming more selective in who they deal with, Varga suggested that there are still many companies running around saying, "Find me, buy me, take me."

He said he therefore believes acquisition activity will continue at a fevered pitch but will not exceed last year's 300 deals. "We'll probably see between 250 and 290 deals this year with value of less than the record-setting $5 billion of last year."

There were 138 transactions during the first half of 1986, off 13% from the first six months of 1985, the report noted. "While acquisitions accounted for 63% of the transactions recorded in the first half of 1986, divestitures contributed 33% and tender offers, 4%," Varga observed.

The five megadeals in the first half of this year were Citicorp's acquisition of Quotron Systems, Inc. ($657.6 million); Borg-Warner Corp.'s purchase of Chilton Corp. ($243.8 million); International Thompson Organisation Ltd.'s takeover of Cordura Corp. ($200.7 million); Allen & Co.'s leveraged buyout of Control Data Corp.'s Ticketron unit ($165 million); and U.S. West Co.'s purchase of Applied Communications, Inc. ($107.5 million).

COMPUTER INDUSTRY

5¢ 10¢ NICKELS AND DIMES

Altos Computer Systems, Inc. announced revenue for the first quarter of $32.6 million, compared with $31.7 million in the like quarter a year ago. Profits were $1.3 million, or 10 cents per share, compared with $2.3 million, or 16 cents per share, a year ago.

■

Scientific Micro Systems, Inc. announced revenue for the third quarter ended Sept. 30 of $17 million, compared with $9.8 million a year ago. The company reported a net income of $747,000, or 10 cents per share, compared with a net loss of $223,000, or 3 cents per share, in the comparable period a year ago.

■

Valid Logic Systems, Inc. reported revenue for the third quarter ended Sept. 30 of $16.6 million, compared with $12.2 million in the previous year.

Profits were $407,000, or 3 cents per share, compared with $256,000, or 2 cents per share, a year ago, the company said.

■

Convex Computer Corp. reported net income of $1.1 million, or 8 cents per share, on revenue of $10.7 million for the third quarter ended Sept. 30. This compares with a net loss of $1.2 million, or 9 cents per share, on revenue of $3.6 million in the like period a year ago.

■

Baron Data Systems announced revenue for the second quarter ended Sept. 30 of $13.6 million, 152% higher than the $5.5 million reported for the second quarter of last year. Profits were $227,000, or 8 cents per share, compared with $287,000, or 14 cents per share, in the like quarter a year ago.

■

Applied Magnetics Corp. announced revenue for the year ended Sept. 30 of $128.1 million, compared with $35.6 million in the previous year. Profits were $5.5 million, or 81 cents per share, compared with $3.1 million, or 48 cents per share, a year ago.

For the fourth quarter, revenue was $35.6 million, compared with $30.8 million one year ago. Profits were $1.3 million, or 19 cents per share, compared with a net loss of $330,000, or 5 cents per share, in the like period a year ago.

■

Interleaf, Inc. announced revenue for the second quarter ended Sept. 30 of $8.6 million, an increase of 126% from $3.8 million in the like quarter last year. Net loss was $251,000, or 2 cents per share, compared with $963,000, or 12 cents per share, a year ago.

■

Priam Corp. reported revenue for the first quarter ended Sept. 30 of $27.3 million, compared with $30.3 million in the previous year. The company recorded a net loss of $4.8 million, or 20 cents per share, compared with net income of $245,000, or 1 cent per share, a year ago.

■

Cipher Data Products, Inc. reported net income for the first quarter ended Sept. 30 of $1 million, or 7 cents per share, on revenue of $44.8 million. This compares with net income of $655,000, or 5 cents per share, on revenue of $35.2 million reported in the like period a year ago.

■

Wyse Technology announced revenue for the second quarter ended Sept. 30 of $59.7 million, compared with $38.9 million one year ago. Profits were $4.3 million, or

See NICKELS page 112

NICKELS from page 110
36 cents per share, compared with $3.2 million, or 30 cents per share, in the like quarter a year ago.

■

Mentor Graphics Corp. announced revenue for the third quarter ended Sept. 30 of $45 million, compared with $34.3 million a year ago. Profits were $2.9 million, or 18 cents per share, compared with $1.4 million, or 9 cents per share, in the like period a year ago.

■

Northern Telecom, Inc. reported net income for the third quarter ended Sept. 30 of $59.4 million, or 51 cents per share, compared with $58.4 million, or 50 cents per share, in the like period a year ago. Revenue was $1.03 billion, compared with $995 million a year ago.

■

Britton Lee, Inc. announced revenue for the third quarter ended Sept. 30 of $7.8 million, compared with $7.1 million a year ago. Profits were $132,000, or 2 cents per share, compared with $122,000, also 2 cents per share, in the comparable period last year.

■

Quantum Corp. announced revenue for the second quarter ended Sept. 28 of $29.6 million, compared with $29.1 million in the previous year. Profits were $2.7 million, or 30 cents per share, compared with $4.4 million, or 45 cents per share, in the like period a year ago.

■

Rexon, Inc. reported revenue for the year ended Sept. 28 of $54.2 million, compared with $33.5 million a year ago. Net income was $3 million, or 40 cents per share, compared with a net loss of $6 million, or $1.97 per share, in the year-earlier quarter.

For the fourth quarter, net income was $650,000, or 8 cents per share, on revenue of $13.2 million. This compares with net income of $462,000, or 6 cents per share, on revenue of $13.1 million in the comparable period a year ago.

■

NBI, Inc. reported a loss of $877,000, or 10 cents per share, on revenue of $72.1 million for the first quarter ended Sept. 30. This compares with a loss of $2.8 million, or 9 cents per share, on revenue of $70 million for the like period a year ago.

■

Comshare, Inc. announced net income for the first quarter ended Sept. 30 of $502,500, or 19 cents per share, compared with $719,900, or 25 cents per share, for the same period a year ago. Revenue for the quarter was $16.8 million, which was essentially unchanged from last year.

■

Chips and Technologies, Inc. announced revenue for the quarter ended Sept. 30 of $13.4 million, compared with $2 million in the previous year. Net income was $2.3 million, or 20 cents per share, compared with a net loss of $492,000, or 4 cents per share, in the like period a year ago.

■

Lee Data Corp. announced revenue for the second quarter ended Sept. 30 of $28.2 million, compared with $22.7 million for the same period last year. Profits were $1.4 million, or 10 cents per share, compared with $1 million, or 7 cents per share, in the previous year.

■

Tandy Corp. announced revenue for the first quarter of $742.5 million, compared with $650.8 million a year ago.

Profits were $43.7 million, or 49 cents per share, compared with $41.7 million, or 47 cents per share, in the prior year.

Timeplex, Inc. announced revenue for the first quarter ended Sept. 30 of $33.3 million, compared with $29 million in the like period last year.

Profits were $7.6 million, or 88 cents per share, compared with $3 million, or 34 cents per share, in the same period a year ago.

■

Datapoint Corp. announced net earnings for the fourth quarter ended July 26 of $231,000, or 1 cent per share, on revenue of $89.1 million. This compares with a net loss of $5.9 million, or 32 cents per share, on revenue of $125.1 million in the like quarter a year ago.

For the year, the company reported revenue of $325.2 million, compared with $520.2 million in the previous year. The company reported a net loss of $8.6 million, or 48 cents per share, compared with a net loss of $48.3 million, or $2.46 per share, a year ago.

COMPUTER INDUSTRY

SUPERSHORTS

Beleaguered software distributor **First Software Corp.** has filed a reorganization plan with the U.S. Bankruptcy Court in Massachusetts in an attempt to emerge from Chapter 11 of the U.S. Bankruptcy Code.

Methuen, Mass.-based First Software filed for protection from its creditors last April and reported $32.6 million in liabilities. Among the largest creditors are **Lotus Development Corp.**, owed $1.4 million, and **Micropro International Corp.**, which is owed $1.2 million.

■

The federal government has agreed to participate in an industry-sponsored program of university research carried out by the **Semiconductor Research Corp.** (SRC).

A research cooperative with 36 member companies, SRC will receive initial funding of $1.2 million from the government. **The Department of Defense** is providing $1.1 million of the initial funds and **National Science Foundation** (NSF) is providing $100,000. NSF will administer the agreement with the SRC.

SRC companies provide $18 million a year for research directed to the mainstream of the silicon chip technology. The program furnishes more than half of all the funds going to universities for silicon-based semiconductor research.

■

Calcomp Products, Inc., a supplier of computer graphics products, has become part of **Lockheed Corp.'s Information Systems Group** (ISG).

Calcomp had been a unit of **Sander Associates, Inc.**, which Lockheed acquired for $1.2 billion in August.

William P. Conlin, president of Calcomp and a newly elected vice-president of Lockheed, said Calcomp will enjoy autonomy of operations under ISG.

■

Quantum Corp., a manufacturer of Winchester disk drives, has filed a motion in U.S. District Court in San Jose, Calif., requesting a summary judgment on one claim in its patent infringement suit filed this year against **NEC Corp., NEC Information Systems** and **Mountain Computer, Inc.**

Quantum also has requested a preliminary injunction prohibiting further infringement. A hearing has been set for Dec. 10.

■

Sorbus, Inc. announced an agreement with **Comdisco Maintenance Services, Inc.**, a wholly owned subsidiary of **Comdisco, Inc.**, to offer nationwide service for Comdisco's IBM 4300 customer base.

Sorbus, the largest maintainer of IBM computer equipment, with specific expertise in the 4300 series, is expected to significantly expand Comdisco's service coverage for this product area.

■

European Interactive Media (EIM), counterpart to **American Interactive Media, Inc.** (AIM), has been formed by compact disk pioneers **Philips International** and **Polygram B.V. International** to spearhead the European development of software for the new compact disk interactive system.

Byron Turner, former director of creative development in Europe for Activision, Inc., has been named president of EIM, which will be headquartered in London.

■

Lee Data Corp. announced that its board of directors has adopted a shareholder rights plan in which rights to purchase Lee Data common stock will be distributed as a dividend at the rate of one right for each share of common stock held by shareholders of record on Oct. 1, 1986. The rights are automatically part of the shares currently outstanding and will be traded with them.

The shareholder rights plan is designed to help management obtain fair and equal treatment for all Lee Data shareholders in the event of any proposed takeover of the company.

The TeleVideo 905 terminal. What a difference $10 makes.

Let's face it; there are a lot of $399 terminals being sold these days. You get a basic box, a few tacked-on bells and whistles, and not a whole lot more.

But now there's the TeleVideo® 905. At $409, it has a feature set so powerful, your customers will think they're sitting at an expensive workstation.

For example, there's a sleekly designed monitor case with full tilt and swivel.

A full-size keyboard with sculptured keycaps for smooth, comfortable typing. Sixteen non-volatile, programmable function keys. Keyswitches that have been tested to 100,000,000 strokes. Even an enhanced numeric keypad.

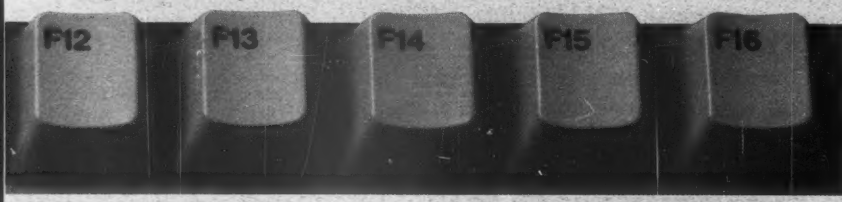
There's also a buffered printer port. And, of course, compatibility with the TeleVideo 925 command set, the most popular and widely emulated ASCII command set in the world.

If you'd like more information just get in touch with the nearest TeleVideo regional office listed below, and we'll give you the name of your nearest distributor.

The TeleVideo 905. What a difference $10 makes.

TELEVIDEO 905 VS. WYSE WY-30

FEATURES	TELEVIDEO 905	WYSE WY-30
Individual programmable function keys	16	4
Tilt and swivel standard	Yes	No
High contrast super dark Matsushita screen	Yes	No
WordStar® mode	Yes	No
Full-size keyboard	Yes	No



TeleVideo®

Settle for more.

TeleVideo Systems, Inc., 1170 Morse Avenue, Sunnyvale, CA 94088-3568, (408) 745-7760, Regional Offices: Northwest (408) 745-7760, Southwest (714) 476-0244, South Central (214) 550-1060, Southeast (404) 447-1231, Midwest (312) 397-5400, East (516) 496-4777, Northeast (617) 890-3282. AMSTERDAM: 31.2503.35444, PARIS: 33.1.4687.34.40, LONDON: 44.9905.6464.

NEW PRODUCTS

Mac, PBX tied under joint development

A 19.2K bit/sec. connection between Apple Computer, Inc.'s Macintosh and Northern Telecom, Inc.'s Meridian SL1 private branch exchange (PBX) was recently announced by the two companies. The link is the first fruit of a product development alliance initiated last January.

In order to accomplish the link, a user must have, in addition to an SL1 PBX and a Macintosh computer, cabling, software, and an Asynchronous Interface Line Card (AILC), which Northern Telecom sells for $1,324, to support data devices.

The physical connection consists of several different cable types that connect a Macintosh to an RS-232 port or to an RJ-11 connection. The cables are priced at $30 each.

Intalk, a communications program for the Macintosh from Palantir Software, Inc. of Houston, has been certified by Northern Telecom to work with the system.

Intalk, priced at $145, can operate up to 32 soft keys identifying data services. The keys are displayed on the Macintosh screen and can be selected by clicking the mouse.

According to a Northern Telecom spokesman, a major benefit of the link is its ability to connect the Macintosh to other manufacturers' computer equipment. Customers can use Northern Telecom's computer-to-PBX interface to communicate with Digital Equipment Corp. minicomputers through the PBX. Used in combination with the AILC and Hewlett-Packard Co.'s Advanced Terminal Processor, the link will allow Macintosh computers to communicate with HP computers.

In addition, Macintosh users can communicate with IBM computers through Northern Telecom's protocol converter, which provides System/36, 38 and 3270 terminal emulation through dial-up access to shared ports.

A Northern Telecom spokesman said a connection with the Apple IIGS may be established in the future and that an Appletalk connection is also expected.

Data base interface unveiled

BBJ Computers adds DEC DBMS link to generator

BBJ Computers International of San Francisco has announced a relational data base interface to its Today self-contained application generator. The interface is said to allow applications written with Today to be built on top of Digital Equipment Corp.'s RDB/VMS relational data base system.

Today suports fourth-generation forms creation and management, report writing and data access to RDB/VMS as well as the automatic generation of RDB/VMS relational tables directly from the Today active data dictionary. Also supported is optional lower level direct access to RDB/VMS data through the system's native algebraic language.

According to the vendor, Today is a fourth-generation language that can insulate developers and end users from the host operating system. It includes capabilities for multiversion application tailoring, interactive end-user training, structured documentation preparation and a full set of administrative security functions for managing the application maintenance and enhancement process.

Today's product architecture is said to be access method and data base management system independent, so Today can function as a visually oriented front end in conjunction with native operating system access methods. It already runs in conjunction with Hewlett-Packard Co.'s Image and the Britton Lee, Inc. Data Base Machine.

Today's access method and DBMS independence allow applications to be moved between operating systems and DBMS/access method environments. It offers developers a common set of system building tools while at the same time giving them the ability to choose the data base or host file management system most appropriate for a given set of site requirements, the vendor said.

Today maintains its own active data dictionary. When used with relational systems, it provides facilities for autogenerating the DBMS commands required to create the data base tables that will actually hold the application data and that correspond to Today's own data dictionary elements, according to the vendor.

In a DEC VAX/VMS environment, Today is priced from $6,000 on a Microvax to $50,000 on a VAX/8600. Runtime versions range from $1,200 on the Microvax to $17,500 on the VAX/8600, the vendor said.

Decision support software system said to ease combination of discrete data

Thorn EMI Computer Software, Inc. of Chelmsford, Mass., has announced the latest version of FCS for IBM mainframes running VM/CMS and MVS/TSO.

FCS is a decision support software system. The new release is said to incorporate single-source data concepts, allowing data held in a variety of data bases, files, models or systems to be combined in a single model without transfer or duplication.

According to a company spokesman, other added features include automatic or user-controlled windows for option selection and viewing as well as color support, offered throughout the product, and three-dimensional graphics capabilities. Access to data in external sources, to be used within any FCS model or application, and screen-driven report generation are both now possible, the spokesman said.

FCS reportedly uses business English syntax and can be command or menu driven. Basic modeling features include more than 180 precoded functions, user-defined functions, a report writer, three-dimensional color graphics, what-if analysis, Monte Carlo simulation and statistical analysis and integrated consolidation .

Pricing for FCS starts at $60,000, the vendor said.

SOFTWARE & SERVICES

Systems software

Synergy Health Systems, Inc. has announced **Basic Claims Processing System** (BCPS), an on-line health claims processing software system.

BCPS is said to automate the payment and verification of claims while gathering data for benefits analysis.

It permits each user to control the specific payment that is to be allowed on each claim. BCPS can compile a series of management reports and can provide a real-time data base on employee and provider demographics, dependents, current and prior benefits, pricing and claims and financial history.

BCPS runs on the Hewlett-Packard Co. 3000 computer. The standard system costs $57,000. The advanced system, which includes the source code and can be customized to meet a specific requirement, costs from $150,000.

Synergy, Suite 201, 16775 Addison Road, Dallas, Texas 75248.

■

Goal Systems International, Inc. has announced **Alert/XP**, a data set security product for IBM mainframe installations using the DOS/VSE Version 1 and VSE/SP Version 2 operating systems.

Alert/XP is said to provide security for data sets, libraries and job submission. It secures the resources accessible to normal batch jobs and the level of access permitted to those jobs. It also provides for controlled access to VSAM data sets, non-VSAM data sets residing on direct-access devices and tape data sets.

Alert/XP is priced at $9,100 for a permanent license or $228 per month for a three-year renewable license.

Goal Systems, 5455 N. High St., Columbus, Ohio 43214.

■

Harris Corp. has announced that its **ADA compiler** has been validated by the U.S. Department of Defense and is available as part of the **Harris Ada Programming Support Environment** (HAPSE).

The HAPSE system is for the large-scale development of application, real-time and system software. In addition to the Ada compiler, HAPSE includes an integrated configuration control and configuration management system, a symbolic debugger with windowing features, program library management utilities and the run-time system.

The HAPSE compiler also includes an on-line Help facility and error recovery techniques.

The HAPSE system is priced at $50,000.

Harris, 2102 W. Cypress Creek Road, Fort Lauderdale, Fla. 33309.

■

Iris Software has announced **Dgen/36**, an on-line documentation generator for IBM System/36 RPG II programs.

Dgen/36 is said to analyze RPG program statements and create documentation that is inserted as commented source directly into the RPG program or stored as a separate library member.

The five documentation types available are lists, cross-reference lists, indented subroutine lists, indicator usage and screen images.

Dgen costs $295.

Iris Software, P.O. Box 4594, Suite 219, 119 Broadway, Chico, Calif. 95927.

SAS Institute, Inc. has ported its **SAS System Version 5** to the Prime Computer, Inc. Prime 50 series running the Primos operating system.

According to the vendor, SAS System Version 5 provides Prime users with the ability to integrate data manipulation and analysis with graphics, applications development, spreadsheets, operations research and financial modeling and planning as well as with interactive matrix programming.

New features to the software include five additional macro functions and the ability to select the most efficient sort of data, either by the SAS System or by the host.

First-year corporate license fees range from $1,500 to $8,000 for base SAS software. Application module prices range from $750 to $6,000 each.

SAS Institute, Box 8000, SAS Circle, Cary, N.C. 27511.

NEW PRODUCTS/SOFTWARE & SERVICES

Dyl-Audit, Sterling Software Dylakor Division's EDP auditing system, has been enhanced to include a two-up letter-writing capability.

Release 4.8 of the product is also said to enable users to generate reports and combined letters of up to a 260-char. width.

Additionally, an exit facility has been added to the system that allows users to access the letter line prior to printing or to direct the letter line to another device, the vendor said.

Dyl-Audit operates in either a free- or fixed-form language with the vendor's Dyl-280 II file and information handling system and with the report writer utility software systems Dyl-280 and Dyl-260.

Release 4.8 of Dyl-Audit costs $21,800.

Sterling Software, Dylakor Division, 17418 Chatsworth St., Granada Hills, Calif. 91344.

Applications packages

Primavera Systems, Inc. has announced **Version 1.7** of its **Primavision** plotter graphics software package.

Primavision is said to generate presentation-quality, time-scaled bar charts and network logic diagrams.

Features of Version 1.7 include an alternative placement algorithm for network logic diagrams; the ability to prepare summary bar charts on the basis of any activity code or combination of up to five different activity codes; and the ability to plot the original target plan as a bar chart on which triangles denote the currently scheduled finish date or actual finish date for each activity.

Primavision costs $1,500.

It runs on the Digital Equipment Corp. VAX or under Microsoft Corp. MS-DOS or IBM PC-DOS.

Primavera Systems, Suite 925, Two Bala Plaza, Bala Cynwyd, Pa. 19004.

National Information Systems, Inc. has announced **Vuecost**, a cost module for its Vue project management system.

Vuecost is said to allow project budget planning and cost tracking.

Features include the ability to set up account codes in three different ways and to provide full resource rate tables that feed the scheduling portion of Vue to automatically calculate costs incurred by resources on individual activities.

Vuecost also provides password-protected access to cost data.

Some reports provided are budget vs. plan, performance, earned value, profitability, breakdown and cumulative cost graph, the vendor said.

Vue project management is priced from $995 to $37,000. The Vuecost module costs from $1,795 to $14,000.

National Information Systems, 20370 Town Center Lane, Cupertino, Calif. 95014.

■

Rem Associates has announced **Release 5** of the **Remdoc** automated documentation package, designed especially for IBM System/36 Cobol users.

Added features include simulated printer layouts from Cobol source code.

Cobol users will be able to include source and procedure narratives via a full-screen editor as part of the Remdoc Runbook facility, according to the vendor.

Other features include reports showing file usage, system flowcharts and field glossaries as well as menu and screen layouts.

Remdoc is priced at $1,250.

REM Associates, P.O. Box 527, Village Station, New York, N.Y. 10014.

Languages

Lattice, Inc. has announced the **Lattice VAX to MS-DOS C Cross Compiler, Version 3.1** for Digital Equipment Corp.'s VAX/730 systems running VMS, Unix and University of California at Berkeley Unix Version 4.2.

The cross-compiler allows users to take advantage of the larger system's speed and multiuser capabilities to create applications for most Microsoft Corp. MS-DOS personal computers.

Version 3.1 includes expanded MS-DOS libraries, case sensitivity with external symbols, enhanced capabilities for generating debugging information and added features to the LC command.

The Lattice VAX to MS-DOS C Cross Compiler Version 3.1 including linker costs $5,000.

Lattice, P.O. Box 3072, Glen Ellyn, Ill. 60138.

NEW PRODUCTS/SOFTWARE & SERVICES

Hewlett-Packard Co. has announced the **HP C/XL** C language compiler for its HP 3000 900 business computers.

The C compiler is said to be compatible with the portable C-compiler standard from AT&T and with the proposed ANSI C compiler standard. It is also compatible with C compilers now available for HP 3000 systems.

The compiler carries full symbolic debug and optimizer support and gives access to all features of the HP 3000 multiprogramming executive operating system.

The HP C/XL compiler is priced at $7,000.

Hewlett-Packard, 1820 Embarcadero Road, Palo Alto, Calif. 94303.

■

Hewlett-Packard Co. has announced an enhanced logic programming language called **HP Prolog** for use with its HP 9000 Model 320 technical workstation.

According to the vendor, users of the Model 320 workstation will be able to alternate between the Prolog and Common LISP languages and intermix code. They will also have access to other programming languages, such as C, Pascal and Fortran.

HP Prolog is an enhanced version of Prolog. It supports Edinburgh C-Prolog syntax, allowing the importation of existing Prolog code.

As a stand-alone system, HP Prolog costs $4,050. A Prolog development system will be added to the Model 320 AI development workstations for a price increment of $4,000.

Hewlett-Packard, 1820 Embarcadero Road, Palo Alto, Calif. 94303.

Utilities

Structured Technology Corp. has announced **Super Search**, an inquiry-generator system for Tom Speed-I-based applications on the Wang Laboratories, Inc. 2200 and compatible personal computers via Niakwa's Basic 2C.

Super Search provides the ability to develop and maintain specialized inquiry screens and indices for any Speed-I file within the system. Features include a generalized inquiry driver, the ability to search files alphabetically based on one character and the ability to paint a display image for each inquiry.

Super Search costs $1,295.

Structured Technology, 2340 Whitney Ave., Hamden, Conn. 06518.

■

Template, the software division of Megatek Corp., has announced the **Blox/Template User Interface Management System** for the Digital Equipment Corp. VAX computer running VMS.

Blox/Template is said to provide tools for use in developing parts of engineering and scientific graphics applications without the need to write code. It is said to be device-independent. It consists of Picturedit, a generalized graphics editor; Tablegen, an interactive screen editor; Helpgen, for automatic generation of on-line Help files; an Interaction Handler that creates the linkage between the user interface and the application subroutines; and Template, a two- or three-dimensional graphics subroutine system.

Blox/Template is priced from $13,000.

Template, 9645 Scranton Road, San Diego, Calif. 92121.

■

Intermetrics, Inc. has announced the **Batch Scheduler System**, a Unix-based utility for sequencing background jobs.

The software features job submission, queue and job display and mail notification upon job completion. Multiple execution streams, deferred, delayed and express job scheduling, CPU time-limited express jobs, job scheduling by user identification and project teams are all user-configurable.

Batch is said to run on Sun Microsystems, Inc.'s Sun-2s, Sun-3s and any Digital Equipment Corp. VAX running Unix 4.2 or 4.3.

Batch is licensed for $1,000.

Intermetrics, Inc., 733 Concord Ave., Cambridge, Mass. 02138.

■

Flavors Technology, Inc. has announced its **VAX/Symbolics Bus-Link**, designed to tie together Digital Equipment Corp. VAX computers and the Symbolics, Inc. 3600 family of artificial intelligence computers.

Bus-Link couples to the VAX Unibus or Microvax Q-bus under VMS and to the Symbolics L-bus, allowing part of the VAX/Microvax memory to share data with the Symbolics computer and to appear as a transparent expansion of the Symbolics memory. Bus-Link consists of a board for each of the processors, two 50-ft shielded cables for 32-bit data transfer and software for diagnostics and debugging.

The VAX/Symbolics Bus-Link is priced at $18,000.

Flavors Technology, 10 Northern Blvd., Amherst, N.H. 03031.

■

Realia, Inc. has announced **Screenio**, a panel definition and screen management facility for Realia Cobol.

Screenio is a subrouting that manages the display screen and keyboard to allow users to perform formatted screen I/O on IBM Personal Computers and compatibles. The Screenio package includes a panel editor facility for creating screen images and the Screenio subroutine, which is called to display screens.

Screenio is priced at $400.

Realia, 10 S. Riverside Plaza, Chicago, Ill. 60606.

■

Logical Devices, Inc. has announced **Computer Automated Silicon Translator** (CAST), a logic compiler for configuring progammable logic devices to designers' logic circuit equivalent.

Features include the ability to do design verification by simulating the input parameters and recording the output results.

CAST uses a proprietary logic reduction/minimization algorithm, the vendor said.

Two methods of design entry included are truth table-state table entry and Boolean logic/state equation entry.

The CAST basic package is priced at $495.

The optional simulation costs $150. Device library updates cost from $50 to $100.

Logical Devices, 1321 N.W. 65th Place, Fort Lauderdale, Fla. 33309.

■

Bakken and Associates has announced **Bakenman**, a translator package that converts IBM System/34 or System/36 RPG II to mainframe-compatible Cobol.

The translator reads in RPG II and produces ANSI Cobol for IBM OS/MVS-type systems, according to the vendor.

The on-line programs are translated to be IBM CICS command level programs.

The basic translator costs $12,900 for a lifetime license.

Bakken and Associates, 2666 Cedar Creek Road, Jackson, Wis. 53037.

■

Outlook Software, Inc. has announced the **Outlook Report Writer** for the IBM System/38.

According to the vendor, the Outlook Report Writer is an assembler-based product that provides access to the System/38 data base.

Information from up to 15 files can be accessed at once.

The information can then be manipulated and output in the form of reports, on-line displays, graphs and file interfaces, according to the vendor.

Features include use of up to 100 fields, full election criteria when accessing file information and job streaming.

The Outlook Report Writer costs $5,500.

Outlook Software, Suite 117, 1 Woodfield Lake, Schaumburg, Ill. 60195.

NEW PRODUCTS/SOFTWARE & SERVICES

Traeger & Associates has announced **Panorama**, software said to allow for development of man-machine on-line interfaces to IBM CICS programs.

Panorama provides for menu generation, security at every level and Help function generation, according to the vendor.

Panorama allows application menu views and access to be developed at either the mainframe or personal computer level and migrates without changes to the mainframe or PC, according to the vendor.

Panorama runs under DOS/VSE and CICS operating systems.

It is priced at $24,000 per copy, which includes the PC interface, according to the vendor.

The software also runs under MVS/CICS for $36,000 per copy.

Traeger & Associates, P.O. Box 18199, Garden City, Ga. 31418.

MIS Training Institute, Inc. has announced **Expert Auditor-CICS**, designed to run on an IBM Personal Computer or compatible.

The software is an artificial intelligence system said to help users review CICS in areas such as system programming, data base integrity, environmental security, CICS statistics and tables, application controls and data access controls.

The system provides a step-by-step audit plan and analyzes the results, according to the vendor.

Expert Auditor-CICS is priced at $1,195 for a single copy.

The annual maintenance fee is $300.

MIS Training Institute, 4 Brewster Road, Framingham, Mass. 01701.

Data base management systems

Relational Technology, Inc. has announced **Ingres for the UTS-3270** environment, which allows Ingres users to run applications on IBM 3270 block-mode terminals.

Ingres is a distributed SQL relational data base system, and UTS is the Amdahl Corp. Unix operating system for IBM and compatible mainframes.

Ingres for UTS-3270 is available as an option to the basic Ingres UTS product.

It adds the feature of IBM 3270 bisynchronous terminal support, according to the vendor.

Ingres for UTS-3270 is priced from $8,000 on the IBM 4331 to $28,000 on the IBM 3090.

The base price for Ingres on UTS ranges from $30,000 to $140,000.

Relational Technology, 1080 Marina Village Pkwy., Alameda, Calif. 94501.

■

Software House has announced **Version 6** of its **System 1032** data base management system for Digital Equipment Corp. VAX systems.

According to a company spokesman, Version 6 allows users to customize the command language and adds features for designing screen forms.

The system also includes an interface to SAS Institute, Inc.'s SAS statistical package and supports bulk updates.

System 1032 licenses are priced from $8,000 for a Microvax I.

Software House, 1000 Massachusetts Ave., Cambridge, Mass. 02138.

■

Sun Microsystems, Inc. has introduced **Sunsimplify** and enhanced its Sununify relational data base system.

Sunsimplify is a set of front-end interfaces for Sununify on Sun's technical workstations.

The system features a graphical, window-based tool for creating and displaying data relationships and a window-based display and update tool.

It also offers local and remote access to the relational query language, report generator and menu capabilities of Sununify.

Sunsimplify also provides a programmer's interface to the underlying data base system, the vendor said.

Sununify can now store large amounts of text, the vendor stated, such as full documents and images and diagrams.

Sununify, including all the capabilities of Sunsimplify, costs $3,195.

Sunsimplify alone is priced at $1,200 per workstation.

Sun Microsystems, 2550 Garcia Ave., Mountain View, Calif. 94043.

NEW PRODUCTS/SOFTWARE & SERVICES

Services

The Productivity Group, Inc. has announced its **Project Development Methodology** (PDM) for systems development.

PDM is said to define the roles and responsibilities of all interdepartment and intradepartment groups that are involved with the project team.

It is checklist- and example-oriented.

According to the vendor, it provides the information processing professional with the framework for integrating the project within a range of general business issues and automation options.

PDM is a 300-page document supported by training materials.

It is priced at $495.

The Productivity Group, Suite 32 S., 305 W. 98th St., New York, N.Y. 10025.

MICROS

Systems

Electronic Form Systems has announced the **Formcoder Workstation**, an IBM Personal Computer AT-based form-creation workstation.

The workstation is said to provide the capability to create government and business forms, as well as convert existing preprinted forms into electronic forms.

The Formcoder Workstation employs a graphics tablet and stylus.

Users can merge variable data generated by software packages such as Lotus Development Corp.'s 1-2-3 with electronically stored forms to produce as many as 20 completed business forms per minute.

The Formcoder includes an 8½- by 11-in. Formviewer 2 monitor with a graphics display unit, adapter card, software and business forms font package, graphics tablet and stylus, IBM Personal Editor and a Formviewer 2 Display System.

Formcoder is priced at $7,750, not including the AT.

Electronic Form Systems, 2395 Midway Road, Carrollton, Texas 75006.

Megatek Corp. has introduced the **911 Graphics Engine**, a personal computer-based, interactive, three-dimensional graphics display system.

The 911 provides the hardware necessary for object design and creation, motion control and real-time previewing of shaded objects. The graphics display system includes a frame buffer that is composed of two 24-bit, 512K- by 512K-byte buffers, an 8-bit, 512K- by 512K-byte buffer and 16 24-bit look-up tables.

It also includes a software library, written in C language, that provides data base manipulation, window management, real-time interaction, multiple light sources and object editing.

Features include 22-bit floating-point, hidden-surface processing; hardware anti-aliasing and a hierarchical display list memory.

The 911 Graphics Engine is priced from $24,900.

Megatek, 9645 Scranton Road, San Diego, Calif. 92121.

■

Datachecker Systems, Inc. has announced its **Series 900 Store Computer.**

The Series 900 is said to be compatible with the IBM Personal Computer AT.

It provides a switch-selectable 6- and 8-MHz CPU. Options include 640K bytes of random-access memory, a 40M-byte internal hard disk drive and an installed parallel port.

There is also a 60M-byte internal streaming tape backup, 2,400 bit/sec. modems and 80- and 132-col. printers available as well.

The Series 900 monochrome system is priced at $5,895 and the color system costs $6,395.

Datachecker Systems, P.O. Box 48090, 2900 Semiconductor Drive, Santa Clara, Calif. 95052.

NEW PRODUCTS/MICROCOMPUTERS

Televideo Systems, Inc. has announced the **Telecat-286**, an IBM Personal Computer workalike system.

The system includes a tilt-and-swivel 14-in. monochrome monitor, 20M-byte hard disk, 1.2M-byte floppy drive, 512K bytes of random-access memory (RAM), a serial and a parallel port and a clock/calendar.

It operates at 6 MHz or 8 MHz, supports both text and graphics and features 32K bytes of video RAM, the vendor said.

The system comes with keyboard and five I/O expansion slots and supports Microsoft Corp. MS-DOS Release 3.1.

The Telecat-286 costs $2,995, according to the vendor.

Televideo Systems, P.O. Box 3568, 1170 Morse Ave., Sunnyvale, Calif. 94088.

Zax Corp. has introduced the **Box-Er**, a Microsoft Corp. MS-DOS based host computer designed to pilot the Zax ICD-series emulators.

The IBM Personal Computer AT-compatible system is said to control Zax ICD-series emulators and development software in the microprocessor development system environment.


Zax Corp.'s Box-Er

The Box-Er allows the user to perform initial software development using compilers, assemblers, linkers, librarians and debuggers available from Zax. Once generated, applications may be downloaded to Zax emulators for real-time testing.

The Box-Er may also be used for menu-driven control of the Zax EZ-198 Programmer.

The Box-Er comes with a keyboard, a color monitor, two 5¼-in. dual-speed disk drives and one 20M-byte fixed drive.

The unit, including MS-DOS software, costs $5,995.

Zax, 2572 White Road, Irvine, Calif. 92714.

Videotelecom Corp. has introduced the **Visionplus** video teleconferencing system for use with an IBM Personal Computer or compatible.

Visionplus is said to incorporate full-motion video, graphics, data and voice. It offers the exchange of full-motion color images between local or remote stations.

Intrastate facilities up to 30 miles apart connect the desktop devices via fiber cable. Intersite hookups require a coder/decoder.

A typical workstation is priced at $5,900. A system of 10 Visionplus workstations, including an interface board, is priced at $69,000.

Videotelecom, 11002-B Metric Blvd., Austin, Texas 78758.

■

Kamerman Labs, Inc. has introduced its **Wait-Less XT** fixed-disk computer system.

The system uses Intel Corp. 8086-1 16-bit technology to achieve 10-MHz performance.

It includes 768K bytes of random-access memory, a 20M-byte fixed disk, floppy drive, IBM Personal Computer AT-style keyboard and an I/O card with clock, serial and parallel ports and floppy controller.

The Wait-Less XT is priced at $1,099.

Kamerman Labs, 7861 S.W. Cirrus Drive, Beaverton, Ore. 97005.

■

Quantex Corp. has announced the **QX-7** IBM Personal Computer AT-compatible image-processing and analysis system.

The QX-7 includes a Quantex-designed plug-in coprocessor board on the PC AT.

It provides the interface between the personal computer and the Versabus chassis containing Quantex's image-processing hardware.

Features include the ability to automatically control the best RS-170 signal in and digitize, average, background-subtract and edge-enhance concurrently in real time.

The system includes the analog boards, processor/memory/control boards, Versabus chassis, Motorola, Inc. 68020 coprocessor board, IBM PC AT, monitor, special keyboard, mouse and software.

Prices range from $30,000 to $50,000.

Quantex, 252 N. Wolfe Road, Sunnyvale, Calif. 94086.

Software applications packages

Software, Inc. has introduced **High Screen**, a screen generator for the IBM Personal Computer XT, PC AT or compatibles.

High Screen is said to handle variables in any language and to be able to test their characteristics in one line of program.

In addition, it does not generate source code. High Screen allows users to open windows, display and manage pull-down menus and manage on-line Help.

The product also allows users to control variable input such as testing the variable type, format and range. It automatically takes care of color, cursor positioning and a Help message, the vendor said.

High Screen consists of a screen generator and a resident driver.

High Screen is priced at $199, ac-

cording to the vendor.

Software, Suite 222, 500 Sutter St., San Francisco, Calif. 94102.

■

Software Technologies has introduced **Mastership**, a purchase order and accounts receivables program.

The software is said to provide orderly processing of incoming purchase orders and tracking of work in process.

It helps schedule jobs, consolidate purchases and prevent overshipments.

The product generates packing and delivery slips, mailing labels, invoices, credit memos, statements and management reports.

Mastership runs on an IBM Personal Computer XT or PC AT or compatibles with 348K bytes of random-access memory and Microsoft Corp. MS-DOS or IBM PC-DOS Version 2.0 or higher.

The package is priced at $895, according to the vendor.

Software Technologies, P.O. Box 110, 51 Lowell Road, Salem, N.H. 03079.

■

Goldstein Software, Inc. has announced **Goldspread**, an integrated spreadsheet program.

Goldspread is said to combine spreadsheet analysis, data base management and graphics capabilities. It allows users to construct and test financial models, predict numeric trends, perform mathematical calculations and present information in charts and graphics form.

Goldspread also maintains file and command compatibility with Lotus Development Corp.'s 1-2-3 spreadsheet program.

Goldspread runs on IBM Personal Computer XTs, PC ATs or compatibles.

The product is priced at $59.95, according to the vendor.

Goldstein Software, 12520 Prosperity Drive, Silver Spring, Md. 20904.

■

Accel Technologies, Inc. has introduced **Tango PCB**, software for designing multilayer printed-circuit boards on an IBM Personal Computer, PC XT, PC AT or compatibles.

Tango PCB is said to display all printed-circuit board layers simultaneously on the viewing screen. It allows printed-circuit board design to go from concept to camera-ready artwork, the vendor claimed. It will design printed-circuit boards as large as 32 in. by 19 in. Features include five zoom levels, nine grid sizes, eight-layer capability and text and component overlay.

The software comes with a library of common components and supports 16 colors in the enhanced graphics adapter 640- by 350-pixel mode and four colors in the color graphics adapter 320- by 200-pixel mode.

Tango PCB is priced at $495.

Accel Technolgoies, 7358 Trade St., San Diego, Calif. 92121.

■

Abracadata Ltd. has released the IBM Personal Computer version of **Everybody's Planner**.

Everybody's Planner includes project management and flow-charting. Users can create project plans and depict process flows. Plans and flow charts can be saved on disk and printed. Plans may be up to nine years long, and a schedule may use up to 2,300 tasks and 9,200 resources, limited by available memory.

The software features eight reports, including graphics and text. Other features include 20 standard flow-chart shapes, editing features, pull-down menus and Help.

Everybody's Planner costs $99.95.

Abracadata, P.O. Box 2352, Eugene, Ore. 97402.

■

Concentric Data Systems, Inc. has announced **R&R**, a relational report writer for Ashton-Tate's Dbase.

R&R is said to allow reports to be prototyped during system design and then to be incorporated directly into production software. R&R can relate and report from up to 10 files at once.

Features include free-form layout of text and fields; calculated fields with more than 60 predefined functions; eight soft levels; plain English query and AND/OR connectors; Lotus Development Corp. 1-2-3-like commands and pull-down menus; and a runtime program for printing R&R reports from within Dbase programs.

R&R is priced at $99.

Concentric Data Systems, P.O. Box 4063, 18 Lyman St., Westboro, Mass. 01581.

■

The Santa Cruz Operation, Inc. has introduced the **SCO Professional**, a Lotus Development Corp. 1-2-3 workalike for Unix and Microsoft Corp. Xenix systems.

SCO Professional allows use of DOS-based Lotus 1-2-3 files within the multiuser, multitasking SCO Xenix System V environment. Existing 1-2-3 files and floppy disks can be read directly by SCO Professional.

Features include a spreadsheet size of 8,192 rows by 256 col., 356 query fields, menu access to Unix system utilities and programmable command execution via macros.

SCO Professional is priced at $995.

The Santa Cruz Operation, P.O. Box 1900, 500 Chestnut St., Santa Cruz, Calif. 95061.

■

Walker Richer & Quinn, Inc. has announced **Reflection 7** and **Reflec-**

Continued on page 124

Continued from page 123

tion 7 Plus color graphics terminal emulation software.

The program is said to emulate Hewlett-Packard Co.'s 2627 color graphics terminal. It requires an IBM Personal Computer or compatible and enhanced color graphics adapter with 256K bytes of random-access memory and an enhanced color monitor. It also emulates HP's 2392, Digital Equipment Corp.'s VT220 and the Tektronix, Inc. 4010 monochrome graphics terminals.

Reflection 7 also features a built-in hard-disk backup capability.

Reflection 7 costs $499.

Walker Richer & Quinn, 2825 Eastlake Ave. E., Seattle, Wash. 98102.

■

ZSoft Corp. has introduced **PC Paintbrush+**, a drawing and painting program said to feature support for image scanners as well as laser printers and video display monitors.

Features include the ability to cut, paste, shrink, grow, rotate, flip, draw with thin or thick lines, draw boxes and rounded boxes, circles, ellipses, curves, spray paint and undo. Each feature works in black-and-white or color.

For scanners, there are pull-down menus to control the contrast, brightness, scanning resolution and gray scale emulation on the screen.

PC Paintbrush+ is priced at $149.

ZSoft, Suite A-495, 1950 Spectrum Circle, Marietta, Ga. 30067.

■

Text Sciences Corp. has announced **Infobank**, a text search and retrieval program for the legal profession.

Infobank is said to browse and search ASCII files using up to 16 search words. Users can specify the common Boolean operators along with wild card, proximity, case and punctuation rules.

Infobank features an integrated file manager and an integrated text reporting facility.

The program runs on IBM Personal Computers and compatibles. It is priced at $995 per copy.

Text Sciences, 5340 San Fernando Road, Glendale, Calif. 91203.

■

Microbar Development Corp. has announced **Shopscan**, its personal computer-based shop floor data collection software package.

Shopscan supports Intermec Corp.'s Crossbar Data Collection Network. It can be either a stand-alone system or a combination front-end processor and data communications system.

Shopscan includes five application modules and the Bar Code Supervisor. Application modules include work-in-process tracking, labor collection, inventory issues and receipt, time and attendance and quality assurance.

The Bar Code Supervisor costs $4,000. The applications cost $2,000 each, the vendor said.

Microbar Development, Suite 218, 12501 Bel-Red Road, Bellevue, Wash. 98005.

Cyma/McGraw-Hill has announced its **Cyma Professional Accounting Series** software for use on IBM Personal Computers.

The software is said to allow the user to define data file formats to store desired information. Many reports are definable, and all screen messages, prompts and report headings can be edited or changed.

The multiuser module allows up to 99 concurrent users with full record-level locking in all data entry and reporting routines. Other features include file maintenance utilities and file condensing utilities.

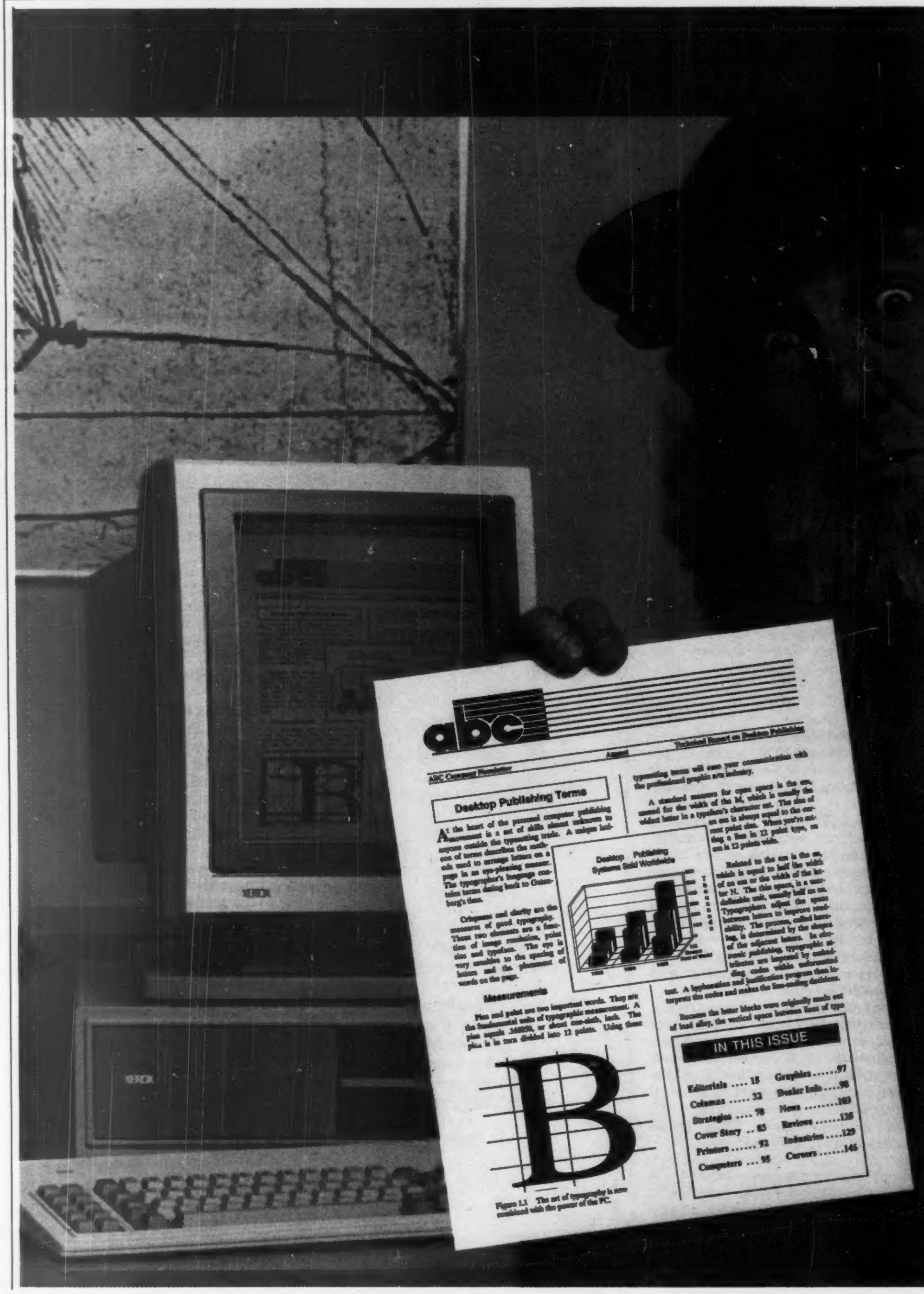
The series consists of General Ledger for $795, Accounts Receivable for $695, Accounts Payable for $695, Payroll for $695, Inventory with Order Processing and Sales Analysis for $995 and the multiuser module for $695.

Cyma-McGraw/Hill, P.O. Box 4122, Mesa, Ariz. 85201.

Data Translation, Inc. has introduced the **Snapshot Storage Scope** data acquisition software package.

The software is said to allow an IBM Personal Computer to collect data converted from analog to digital by the vendor's DT2801 series of data acquisition boards and display the information on its monitor in a form equivalent to an oscilloscope.

The menu-driven package can collect and display data from up to four input chan-



nels and store the collected data for further analysis.

Snapshot Storage Scope costs $495.

Data Translation, 100 Locke Drive, Marlboro, Mass. 01752.

■

PSS, Inc. has announced **Cold Caller**, a personal computer software product for contacting sales prospects by phone.

Cold Caller allows sales representatives to set up and manage their territories on a PC so that prospects can be regularly contacted by both mass mailings and by phone. Telephone calls are automatically dialed and customized scripts presented for the representative to use. Each call generates a report.

Cold Caller runs on an IBM Personal Computer. It costs $895 including software, dialing hardware, telephone headset and user guide.

PSS, 165 W. Putnam Ave., Greenwich, Conn. 06830.

■

Generated Systems, Inc. has announced **Taxfiler**, said to enable employers to meet federal requirements that make it mandatory for organizations with more than 500 employees to report 1986 wage data to the federal government on magnetic media.

Taxfiler is said to meet 1986's federal wage reporting requirements by producing such data on 5¼-in. microcomputer diskettes.

Data may be input to Taxfiler either through the use of menu-driven input screens or through the use of its mechanized import capability.

Taxfiler also enables the user to print W2 forms and produce audit reports. It runs on any IBM-compatible microcomputer.

Taxfiler is priced at $250, according to the vendor.

Generated Systems, Suite 103, 104 E. Roosevelt Road, Wheaton, Ill. 60187.

■

McDonnell-Nabi Systems, Inc. has introduced its **Type-Accountant** integrated accounting system.

The system is said to give typesetters complete job tracking, payroll and accounting functions.

It includes specialized features for typesetters of all sizes, including an integrated electronic time clock for payroll, job tracking and reporting, departmental breakdown of data and customized invoicing and statement generation.

The system is available in single-user and multiuser configurations. It is priced from $2,000.

McDonnell-Nabi Systems, Suite 3, 991 Commercial St., Palo Alto, Calif. 94303.

■

Cpaids, Inc. has announced an Internal Revenue Service electronic filing option for its **Master Tax** and **Standard Tax** programs.

The IRS filing option works in conjunction with the federal tax programs to transmit tax return data from the tax preparer's microcomputer to IRS computers using communications software and modems.

The Cpaids IRS electronic filing option is priced at $200, according to the vendor.

Cpaids, 1061 Fraternity Circle, Kent, Ohio 44240.

Software languages

Taneco Systems, Inc. has announced **TSCOB**, a Level 2 Cobol compiler for the IBM Personal Computer and compatibles.

TSCOB is said to cover all modules: nucleus, table handling, sequential I/O, relative I/O, indexed I/O, sort-merge, segmentation, communication, library, interprogram communciation, report writing, symbolic debugging and screen handling.

TSCOB is available for use under IBM PC-DOS and Microsoft Corp. MS-DOS environments.

It is priced at $145, which includes an indexed file management system, according to the vendor.

Taneco Systems, Suite K, 17461 Irvine Blvd., Tustin, Calif. 92680.

■

Apple Computer, Inc. has announced an enhanced version of its interpreted programming language, **Macintosh Pascal 2.1.**

Macintosh Pascal Version 2.1 features instant feedback, interactive debugging tools and multiple windows. It also includes the ability to

Continued on page 126

Continued from page 125

write programs as large as 2,000 lines, a runtime shell for developing stand-alone applications and no copy protection.

Macintosh Pascal is said to allow users to observe and make changes to variables, expressions and graphics as the program runs.

It also allows users to indent program statements automatically, highlight key words and send output from Macintosh Pascal 2.1 to either text or printer files, according to the vendor.

Macintosh Pascal 2.1 costs $125.

Apple Computer, 20525 Mariani Ave., Cupertino, Calif. 95014.

Software utilities

M/H Group has announced **VSCOM,** software said to allow IBM Personal Computers and compatibles and Wang Laboratories, Inc. personal computers to act as Wang VS terminals using standard asynchronous communications.

VSCOM is said to emulate a Wang 2110 asynchronous terminal connected to a Wang VS asynchronous device controller.

The product also allows bidirectional document and file conversion and transfer over the same asynchronous line.

VSCOM is priced at $395, including PC terminal emulation and document and file transfer software.

The Wang VS Transfer utility costs $495 per VS.

The PC Terminal Emulation costs $195, according to the vendor.

M/H Group, 222 W. Adams, Chicago, Ill. 60606.

■

Intercontinental Microsystems has announced **Attach,** software said to enable Borland International, Inc.'s Turbodos users to utilize any processor to attach their processors to any other processor on the same network.

Attach is said to be able to work between any two Turbodos processors independently of the master/slave assignment.

It excludes multiple slaves from attaching themselves to the master processor.

The product also is said to allow collection of console outputs into a file, so unattended execution of procedures and delayed file reviews for verification of proper execution are possible.

Attach is priced at $150, the vendor said.

Intercontinental Microsystems, 4015 Leaverton Court, Anaheim, Calif. 92807.

■

Pajac Systems, Inc. has announced **The Key,** a software encryption product for IBM Personal Computer users.

The Key is said to enable users to encrypt and decrypt any file on a hard or floppy disk application.

The product also allows transmission of encrypted files over communciations links via most binary communciations programs.

The Key is priced at $89.95, according to the vendor.

Pajac Systems, 114 Waltham St., Lexington, Mass. 02173.

■

Greenleaf Software has released **Datawindows,** a windows and data-entry library for C language programmers.

Datawindows offers overlaid windows with screen management, program simplicity, transaction-oriented data entry and device independence.

According to the vendor, the user can write to any window, whether it appears on the screen or not.

Datawindows comes with documentation. Users may include portions of the object code in programs that they write with no royalty obligations.

Datawindows is priced at $225.

The source code costs $225, according to the vendor.

Greenleaf Software, Suite 101, 1411 LeMay Drive, Carrollton, Texas 75007.

■

Sydetech System Development Technologies has announced the **C-Display Utilities,** display management software for IBM and Texas Instruments, Inc. personal computers.

The product consists of three modules, including C-Display Compiler, the Demoexpress Viewer and the C-

NEW PRODUCTS/MICROCOMPUTERS

Display Librarian. The software provides tools for developing demos and graphics applications.

The C-Display Compiler costs $125. The Demoexpress Viewer costs $29 and the C-Display Librarian, $145.

Sydetech, Suite 17C, 43-23 Colden St., Flushing, N.Y. 11355.

■

MLI Microsystems has announced **Power Tools**, a hard-disk utility designed for use with the IBM Personal Computer.

The memory-resident package is said to allow users to access file management capabilities from within a running program or perform a disk optimization.

Features include the ability to copy or move files or entire subdirectories and format or copy diskettes, the vendor said.

Power Tools also give users the ability to view, edit or print any file or sector and locate any file or string on a disk.

Additional features provide user with the ability to delete files and subdirectories; verify files or disks; map disk usage; and restore data erased or deleted by accident, according to the vendor.

Power Tools is priced at $50.

MLI Microsystems, Box 825, Framingham, Mass. 01701.

Bay Computer Corp. has introduced **Bay Utility**, software said to allow users to automatically track which software programs are being used on a personal computer within an organization.

According to the vendor, every time an operator runs a software program on a personal computer, the Bay Utility software will create a record of the name of the software file being accessed, the time and date of the access and the duration of use of that program.

Bay Utility also includes a menu-driven program that allows the user to combine, sort, summarize and organize the data collected and present the data in management reports. The data can also be exported to Ashton-Tate's Dbase, Lotus Development Corp.'s 1-2-3 and other applications packages.

The Bay Utility costs $99.95.

Bay Computer, York and Haverhill Streets, Andover, Mass. 01810.

■

Articulated Systems, Inc. has announced **Art-4**, an instantaneous report and graphics display module for use in conjunction with the vendor's Art-1 financial software.

Art-4 is said to be a personal computer system featuring instantaneous display of key items. It starts automatically when the personal computer is turned on and presents the most frequently required or important items to the user. It interfaces with Lotus Development Corp.'s 1-2-3 as well as other spreadsheet and graphics applications.

Art-4 is priced at $300.

Articulated Systems, 195 Farmington Ave., Farmington, Conn. 06032.

■

Target Software, Inc. has announced **Voila**, a desk accessory outliner for the Apple Computer, Inc. Macintosh.

Voila is said to run over most Macintosh software. It features unlimited numbers of headlines, subheads and expanders. Users may individually edit fonts, sizes, styles, margins, text alignment and line spacing within each expander window. Features include the ability to edit fonts and styles within individual headlines and subheads or font sizes.

Voila is compatible with Apple's Laserwriter and Imagewriter printers. It runs on a Macintosh 512K or Macintosh Plus. It costs $99.95.

Target Software, 14206 S.W. 136th St., Miami, Fla. 33186.

■

S&S Systems has introduced **Quik/BMS**, an IBM CICS screen development tool.

Quik/BMS runs on a personal computer and automatically generates the BMS macro source code for use on a mainframe computer. It is said to allow users to design and paint CICS screens on a personal computer without the coding of BMS macros. The screens can be reviewed and modified.

Features include a full-

Continued on page 128

NEW PRODUCTS/MICROCOMPUTERS

Continued from page 127
screen editor and the ability to review screens in IBM 3270 format.

Users may also key data into the screen's input fields for testing purposes and download existing mainframe BMS macro source code to the personal computer, according to the vendor.

Quik/BMS is priced at $195.

S&S Systems, P.O. Box 1725, Claremore, Okla. 74018.

■

Calcomp has introduced **Batchplot,** software said to allow users of Autodesk, Inc.'s Autocad computer-aided design software to plot up to 60 drawings in a single batch run on a Calcomp 1042GT or 1044GT pen plotter.

Batchplot also supports the Calcomp 1070 series plotters, 5700 series monochrome and 5800 series color electrostatic plotting systems and Plotmaster plotter/printer. It is a menu-driven utility, and the plotter can be left unattended during the entire batch plotter, according to the vendor.

Batchplot is offered as an option with the Calcomp plotters it supports. It costs $200.

Calcomp, P.O. Box 3250, Anaheim, Calif. 92803.

■

Image Processing Software, Inc. has announced **Turbofonts**, said to allow scientific symbols and foreign languages to be seen on the screen and printed from within word processing software programs for the IBM Personal Computer and compatibles.

Turbofonts is memory resident. It controls the keyboard, screen and printer and allows the user a choice of more than 30 different character sets or complete customization from a library of more than 1,000 characters.

Turbofonts also captures graphical material and allows merging graphics with text during printing.

Turbofonts is compatible with word processing programs such as Microsoft Corp. Word, IBM Volkswriter and Wordperfect Corp. Wordperfect.

Turbofonts costs $149.

Image Processing Software, P.O. Box 5016, 4414 Regent St., Madison, Wis. 53705.

■

Template Techniques, Inc. has introduced **Workflow Manager**, a software template disk for performing project management with Lotus Development Corp.'s 1-2-3.

According to the vendor, the template is designed for professionals working with time, budget and manpower constraints. It allows users to schedule tasks, plan staff assignments, estimate costs and track progress within the Lotus format.

Additionally, the single software disk can be utilized for reporting status in tabular or graphic form and for forecasting final cost and end date.

Features include on-screen bar charting, resource and cost data base and Help key. It runs on an IBM Personal Computer or compatible.

The Workflow manager costs $69.96.

Template Techniques, Suite 102, 16747 Squyres Road, Spring, Texas 77379.

■

Softplus, Inc. has introduced **Menu Please**, a menu management system designed to establish a standard menu interface for any application running on Wang Laboratories, Inc. VS systems.

Menu Please features the ability to modify or restrict menus on-line without interrupting usage; the ability to set usage constants and a beginning and ending procedure for menu entries; hidden program function keys; three modes of operation; and the ability to define or restrict menu entries by groups of users and workstations.

Wang VS Cobol source code is provided to allow users to customize Menu Please to conform to existing systems and standards.

Menu Please costs $295.

Softplus, 79 President St., Brooklyn, N.Y. 11231.

■

Pioneering Controls Technologies, Inc. has announced **Real Tools**, a set of Unix product development tools and C function libraries.

Real Tools includes a screen management system,
Continued on page 131

NEW PRODUCTS/MICROCOMPUTERS

Continued from page 128
windowing capabilities, user-defined graphics and assorted utilities and library functions.

According to the vendor, screens, windows, graphical symbols, bar graphs and text are defined and created by the user.

Real Tools costs $99 for binary, $299 for library source and $399 for complete source.

It is available for AT&T's Unix System V, Santa Cruz Operations, Inc. Xenix, Microsoft Corp. Xenix and IBM Xenix. It can be ported to other Unix-like systems.

Pioneering Controls Technologies, Suite 300, 510 Bering Drive, Houston, Texas 77057.

■

Michael Flinder & Associates has announced an **implementation** of the **Data Encryption Standard** (DES) encryption algorithm in the C programming language.

The DES was developed at IBM for the National Bureau of Standards and is an outgrowth of the Lucifer cipher, also developed at IBM.

DES enciphers 64-bit blocks of data with 56-bit keys using a substitution-permutation strategy, the vendor said.

This implementation is equipped with a turbo option said to increase ciphering throughput more than 15 times.

The source code is priced at $25.

Once bound to a binary application library, Flinder's DES can be redistributed without royalties.

Michael Flinder & Associates, 169 Burnside, Tonawanda, N.Y. 14150.

Software data base management systems

Abracadata Ltd. has announced **Welcome**, an electronic handbook tool for the Apple Computer, Inc. II series computer.

Welcome is a data base including both text and graphics. It enables users to provide and update information for other users. It includes file types for directories, phone lists, mailing lists, job titles and functions, interrelationships, organizational history, goals, emergency procedures, business plans, orientation safety/benefits/insurance and a user-definable category.

The graphic file types include building, lot, parking lot, conference, location map, plan, organizational structure, flow chart and a user-definable category.

Welcome is priced at $79.95.

Abracadata, P.O. Box 2352, Eugene, Ore. 97402.

■

Cosmos, Inc. has enhanced its **Revelation** microcomputer applications development system with capabilities that allow the system to run in multiuser personal computer environments created by use of Anex Technology, Inc.'s Multi-PC, Multi-AT and PC Annex expansion systems.

This is achieved via a bump disk that accommodates the operating requirements of up to four users on a multiuser system.

Revelation reportedly features standard data base management system functions as well as a programming language, compiler, text editor for writing source code and a line editor.

The product also features a debugger, program formatting and listing function, screen generator, query language and report generator, the vendor said.

Additional functions include a menu generator, input screen generator and interfaces to microcomputer local-area networks.

Each bump disk costs $495.

The single-user version of Revelation costs $950, according to the vendor.

Cosmos, 19530 Pacific Highway S., Seattle, Wash. 98188.

Software enhancements

Northwest Analytical, Inc. has announced **Version 4.1** of its **NWA Statpak** statistics package for IBM Personal Computers and compatibles.

The software is said to provide users with presentation-quality graphics, enhanced data management capabilities and added analytical functions.

NWA Statpak sells for $495 per copy, according to the vendor.

Northwest Analytical, 520 N.W. Davis, Portland, Ore. 97209.

NEW PRODUCTS/MICROCOMPUTERS

Deeresoft, Inc. has announced **Magic Menu Version 2.0**.

Magic Menu is a menu system said to provide control of an IBM Personal Computer, PC XT, PC AT or compatible system. It consists of two programs written in assembly language. The user builds the menu system with a separate menu-driven editor.

Features include the ability to attach passwords to any entry on any menu screen, format choices of black and white or color, foreground, background and border colors, date and time display and menu character size. Magic Menu also has an audit trail option and a peripheral control function.

Magic Menu is priced at $99 for a single version and $500 per file server for the network version.

Deeresoft, P.O. Box 1360, Melbourne, Fla. 32902.

■

Minuteman Software has announced **Version 2** of its **GPSS/PC** simulation environment software for IBM Personal Computers and compatibles.

GSS/PC Version 2 includes animation and five additional interactive graphics windows. It includes support for a pointing device, a session journal, a results data base and a built-in analysis-of-variance command for a first-level statistical analysis.

GPSS/PC is priced at $995.

Minuteman Software, P.O. Box 171, Stowe, Mass. 01775.

■

Softest, Inc. has announced the **Softype Desktop Publishing Software, Release 4.0.**

Softype is available for a range of computers including IBM Personal Computers and compatibles as well as systems based on Unix and Microsoft Corp.'s Xenix. Release 4.0 features pop-up menus, landscape mode, complete kerning, widow and orphan control, control of letter spacing and the ability to size graphic images.

Softype 4.0 also includes laser printer drivers for Hewlett-Packard Co.'s Laserjet and Laserjet Plus, Canon U.S.A., Inc.'s A1/A2, Quadram Corp.'s Quadlaser printers as well as Xerox Corp.'s 4045, Imagen and Postscript language printers.

Softype transforms the formatting information within a standard word processing document into appropriate typeset output.

Softype is priced at $1,000 for single-user and $1,500 for multiuser systems.

Softest, 555 Goffle Road, Ridgewood, N.J. 07450.

■

Micro Education Corp. of America has announced **Version 3.0** of Andrew Tobias's **Managing Your Money**, for IBM Personal Computers and compatibles.

Added capabilities include the ability for the user to adopt whichever tax changes are necessary; home banking in conjunction with Chase Manhattan Bank N.A., a notepad said to be accessible from anywhere in the program, a more detailed manual, increased speed, simpler handling of prepayments and variable charges for mortgage loans, the ability to store multiple rental property analyses and the ability to print files in Lotus Development Corp.'s 1-2-3 format.

Version 3.0 of Managing Your Money costs $199.95.

Micro Education Corp. of America, 285 Riverside Ave., Westport, Conn. 06880.

■

Microsoft Corp. has announced **Version 3.0** of **Project**, its project management software for computers running its MS-DOS operating system.

The software was designed for controlling and tracking schedules, resources and costs. Users of Version 3.0 can transfer data to packages like Primavera Systems, Inc.'s Primavera Project Planner.

Other added features include network support, an activity list report and a period demand report.

Microsoft Project Version 3.0 is priced at $395.

Microsoft Corp., Box 97017, 16011 N.E. 36th Way, Redmond, Wash. 98073.

■

Rational Systems, Inc. has announced **Instant-C 2.0,** an incremental compiler for the C language said to process only the parts of a program that the user changes.

The software combines the interactive environment of an interpreter with the execution speed of a compiler, which enables programmers to create programs and maintain or extend existing programs.

It incorporates a full-screen editor, source level debugger, printer, object code linker, source code checker and a run-time checker.

Features include full 640K-byte capacity; support for linking Lattice, Inc. Versions 2.0 and 3.0 and Microsoft Corp. 3.0 object code and libraries; and the ability to handle hardware interrupts in C.

Instant-C 2.0 runs on IBM Personal Computers and compatibles and costs $495.

Rational Systems, P.O. Box 480, Natick, Mass. 01760.

■

Network Software Associates, Inc. has enhanced its **Adapt SNA 3270** IBM 3270 emulator for IBM Personal Computers.

The software now includes support of multiple concurrent mainframe sessions as well as the ability to route host print files to disk.

NEW PRODUCTS/MICROCOMPUTERS

Adapt SNA 3270 emulates an IBM 3274 controller equipped with a 3278/9 terminal and a 3287 printer, allowing PC-to-mainframe communications in IBM Systems Network Architecture environments.

It operates over leased, point-to-point and multidrop lines at speeds of up to 9.6K bit/sec.

A software-only version costs $585. A hardware and software package carries a price tag of $830, which includes an Adaptcom Synchronous Data Link Control adapter board.

A hardware/software package including a 2,400 bit/sec. modem costs $1,380, and a hardware/software package including a 4.8K bit/sec. modem costs $1,780.

Network Software Associates, 22982 Mill Creek, Laguna Hills, Calif. 92653.

Challenger Software has released **Version 2.0** of its **Mac3D** two- and three-dimensional graphics package for the Apple Computer, Inc. Macintosh.

Among the additions to the package are lighting and shading capabilities, the ability to create custom tools and to switch between sets of tools and the ability to make any two-dimensional object into a three-dimensional object.

Other features include the ability to remove perspective effects, allowing the user to see flat models; the ability to reduce, reduce to fit and enlarge viewing modes; and export and import capabilities for communication with other graphics programs.

Mac3D is priced at $195. Registered users of previous versions can upgrade for $30.

Challenger Software, 18350 Kedzie Ave., Homewood, Ill. 60430.

■

Nantucket Corp. has announced the release of the **Autumn '86** version of its **Clipper** compiler for Ashton-Tate's Dbase III and Dbase III Plus.

Autumn '86 is said to produce both single-user and networking applications. It supports Microsoft Corp. MS-DOS 3.1 calls for networking functions, allowing compiled applications to run on networks such as IBM's Token-Ring, Novell, Inc.'s Advanced Netware and 3Com Corp.'s 3+ Network Operating System. The compiler also supports the Lotus/Intel/Microsoft Expanded Memory Specification.

The Clipper Autumn '86 package costs $695. Registered users can update to the new version for $139.

Nantucket, 5995 Sepulveda Blvd., Culver City, Calif. 90230.

■

System Facilities, Inc. has announced **Version 5.01** of its **XPIP** integrated system utility for Microsoft Corp. MS-DOS, IBM PC-DOS and Novell, Inc. Netware systems.

XPIP is said to be a DOS shell and disk manager. The latest version of XPIP includes a sort utility supporting record selection and sorting on multiple keys, a user-definable menu facility for quick and easy access to any user applications and a 73-page manual.

The price of XPIP is $29.95 plus $3 shipping.

System Facilities, P.O. Box 7079, Charlottesville, Va. 22906.

Communications

Advanced Digital Information Corp. has announced its **Model 532**, a ¼-in. cartridge tape subsystem designed for use with local-area networks operating with Novell, Inc. Netware or Microsoft Corp. MS-DOS 3.1 MS-Net software.

The Model 532 is said to provide a starting formatted tape capacity of 67M bytes.

It acts as the host drive to which three of the vendor's modem 530 tape expansion subsystems can be daisy-chained for up to 268M bytes of on-line network tape storage.

The tape emulates a disk drive and provides random-access file addressability.

DOS commands work to and from the tape drive, the vendor said.

The Model 532 costs $3,490.

Advanced Digital Information, P.O. Box 2996, Redmond, Wash. 98073.

■

MBP Software and Systems Technology, Inc. has announced that its **Visual Cobol** Cobol compiler is compatible with Novell, Inc.'s Netware operating system.

Visual Cobol is said to be a full-featured Cobol compiler for IBM Personal Computers and compatibles. It includes a screen management system. Running under Netware, the compiler is said to create multiuser applications with full record-locking and file-locking support.

Visual Cobol for Novell Netware costs $1,450. Single-user versions for Microsoft Corp. MS-DOS cost $1,150.

MBP Software and Systems Technology, Suite 260, 1131 Harbor Bay Pkwy., Alameda, Calif. 94501.

■

Cleo Software has announced the **Cleo 201/212** personal computer-compatible internal modem.

The modem combines a 2,400 bit/sec. synchronous modem with a 1,200 bit/sec. asynchronous modem. It features autodial and autoanswer capabilities.

The single internal interface board requires one expansion slot and one telephone line. It has an RS-423 port for connection to an external modem.

With asynchronous software, the modem costs $1,195. With synchronous software as well, it costs $1,795.

Cleo Software, 1639 N. Alpine Road, Rockford, Ill. 61107.

NEW PRODUCTS/MICROCOMPUTERS

Data storage

Computer Peripherals, Inc. has announced **Drivemaster**, a disk drive controller board for IBM Personal Computers, Personal Computer XTs and ATs.

Drivemaster is said to operate 5¼-in. and 3½-in. diskette drives and 360K-byte and 1.2M-byte media. It supports 48, 96 and 160 track/in. read/write formats. Any combination of up to four internal or external drives and media are interchangeable.

The board includes a built-in buffer memory and read-only memory software.

Drivemaster carries a price tag of $249.

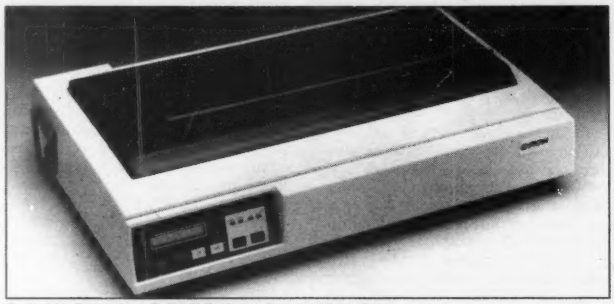
Computer Peripherals, Suite 5, 2635 Lavery Court, Newbury Park, Calif. 91320.

Printers/Plotters/Peripherals

C. Itoh Digital Products, Inc. has announced the **Prowriter C-715 Reliant**, the firm's seven-color, 24-pin dot matrix printer.

The printer offers up to 300 char./sec. printing in draft mode and 100 char./sec. in letter-quality mode.

It uses a plug-in identity card that allows the C-715 Reliant to emulate printers such as the IBM Proprinter XL, the Epson America, Inc. LQ-1000 and the Toshiba America, Inc. 351.



C. Itoh's Prowriter C-715 Reliant dot matrix printer

The Reliant features a quiet mode, proportional printing, automatic paper loading, push-pull tractor and bottom feed.

It has both Centronics Data Computer Corp. parallel and RS-232C serial interfaces, transmission speed of up to 19.2K bit/sec. and a standard 32K-byte buffer.

The C-715 Reliant is priced at $1,295.

C. Itoh Digital Products, Suite 220, 19750 S. Vermont Ave., Torrance, Calif. 90502.

Board-level devices

Boca Research, Inc. has released **Bocaram**, an expanded memory board for the IBM Personal Computer, Personal Computer XT, PC AT and compatibles with CPUs operating at speeds up to 12 MHz.

The midsize add-on board is available in four memory configurations from 10K to 2M bytes.

Bocaram conforms to the Lotus/Intel/Micrososft Expanded Memory Specification. It requires no switch settings for single-board installations and only a DIP switch for more than one board.

Bocaram comes with installation software as well as ram-disk and print-spooler software.

It is priced from $195 for the 10K-byte version to $740 for the 2M-byte version.

Boca Research, 6401 Congress Ave., Boca Raton, Fla. 33431.

Auxiliary equipment

McNulty Development, Inc. has introduced the **Unix Refkey**, Unix/Microsoft Corp. MS-DOS keyboard templates for Unix System.

The templates are said to be based on AT&T's Unix System V and MS-DOS. The templates feature multiple-layer plastic construction and sharp-resolution two-color format.

The information on the template includes commands and their descriptions, hints and procedures and command cross-references for equivalent Unix and DOS commands, the vendor said.

Models are available for the AT&T PC 6300 and AT&T PC 6300 Plus.

Refkeys carries a price tag of $20 each.

McNulty Development, P.O. Box 1167, Piscataway, N.J. 08854.

■

Microsoft Corp. has announced **Microsoft Mouse Version 6.0** with advanced software support and animated graphics capabilities.

The Mouse provides menu support for business applications such as Lotus Development Corp.'s 1-2-3. It also incorporates a graphics presentation software system that allows users to capture personal computer images, create graphics and assemble and give presentations.

The Mouse features 200 point/in. resolution. The sensitivity can be controlled with a pop-up control panel, the vendor said.

The Mouse is available in a serial-port version for $195, a bus version for $175 and an in-port version for $125.

Microsoft, Box 97017, 16011 N.E. 36th Way, Redmond, Wash. 98073.

NEW PRODUCTS/COMMUNICATIONS

COMMUNICATIONS

Controllers

Ungermann-Bass, Inc. has introduced the Network Interface unit **Model DMF32**, a network interface unit for connecting a personal computer or terminal to a Digital Equipment Corp. VAX system over a Net/One local-area network.

The two-board unit plugs directly into the backplane of a VAX system to provide support for up to 32 VAX connections running at speeds up to 19.2K bit/sec.

It emulates four DEC eight-port DMF32 I/O controllers and can off-load Net/One protocol processing from the VAX.

PCs running the vendor's 3270 Personal Connection Model II software can maintain up to two sessions with a VAX minicomputer while simultaneously running PC applications and two high-speed 3270 terminal sessions with an IBM host computer.

The baseband NIUODMF32 model costs $6,495. The broadband model costs $7995.

Ungermann-Bass, 3900 Freedom Circle, Santa Clara, Calif. 95052.

■

Micro Technoloy, Inc. has introduced **Meqna**, a communications controller said to provide a 10M-bit/sec. data transfer rate and the ability to connect Digital Equipment Corp. Q-bus computers to both Ethernet and thin-wire communication channels.

Connection to either Ethernet or thin wire is done through Mesta, a switch-selectable interface panel.

Other features include various parameter and set-up features that can be modified, internal self-tests and a multiple retransmission. It provides packet serialization. The controller employs 64K words of dynamic random-access memory, which provides for increased data throughput.

Up to two Meqnas can be housed in a Q-bus computer. Each Meqna supports one Mesta. Meqna costs $1,825 and Mesta costs $250. Purchased together they cost $1,975.

Micro Technology, 1620 Miraloma Ave., Placentia, Calif. 92670.

■

Carse, Woodworth & Associates, International, Inc. has announced its **SNA/X.25 Network Controller**, said to act as a front-end processor, concentrator and a packet assembler and disassembler.

The controller supports connection of all IBM Systems Network Architecture (SNA) LU interfaces while providing SDLC ports for IBM systems; CCITT X.25 connections for IBM systems; communications in IBM SNA/SDLC environments; host-to-host SNA communications; and connection of SDLC hosts and controllers to packet-switching networks.

As a concentrator, it permits multiple hosts to share communciations lines; full duplex communciations in SDLC environments; and off-loading of link-level error recovery from hosts. The SNA/X.25 supports up to 40 multipoint SDLC or X.25 communication lines at speeds up to 56K bit/sec.

The unit is priced from $30,000.

CWA, Suite 210, 18805 Cox Ave., Saratoga, Calif. 95070.

Standard Microsystems Corp. has introduced the **Arcnet-PC210 Short-Slot Local-Area Network Controller Board** for IBM Personal Computers.

Up to eight Arcnet-PC210s may be daisy-chained together over a distance of 1,000 feet.

The unit incorporates the vendor's surface-mounted COM9026 local-area network controller and the 9032 Arcnet local-area network transceiver circuits to provide protocol handling.

It features a 2K-byte, on-board data packet buffer and an on-board 8K-byte programmable read-only memory socket is available, according to the vendor.

The Arcnet-PC210 costs $595.

Standard Microsystems, 35 Marcus Blvd., Hauppauge, N.Y. 11788.

Voice/data communications

Northern Telecom, Inc. has announced the **Displayphone 220**, an enhanced data terminal with integrated telephone features.

The Displayphone 220 is said to emulate Digital Equipment Corp.'s VT100, CT220 and VT52 models. It operates with the vendor's private branch exchanges, Meridian Sl-1 integrated services networks and Meridian DV-1 data voice systems.

It offers a 9-in. tilt-and-swivel screen that displays in 80 or 132 columns, a serial port and a parallel printer port. Voice features include two telephone lines, a personal directory with automatic dialing, last number redial, hold and mute. An optional internal autoanswer modem operates at 300 or 1,200 bit/sec.

Displayphone 220 costs $895 or $1,095 with an internal modem.

Northern Telecom, 200 Athens Way, Nashville, Tenn. 37228.

Protocol converters

Hinckley Communications, Inc. has added the **EL-ENET** to its Eliminator Series product line.

The EL-ENET is a conversion device providing Ethernet users with the ability to transmit data over twisted-pair wiring to a remote peripheral. It transmits over either 22-gauge or 24-gauge wire and will transmit without degradation for 250 feet from the transceiver box to the remote device.

EL-ENET costs $150 per unit.

Hinckley Communications, 14 Parker Road, Osterville, Mass. 02655.

■

Xpoint Corp. has introduced the **Xpoint 6294** multifunction protocol converter.

The Xpoint 6294 is said to link ASCII terminals, printers and personal computers to multiple IBM System/34, 36 and 38 computers, as well as to non-IBM minis, concurrently.

According to the vendor, to the minicomputer, the 6294 looks like a 5251 Model 12 or 5294 remote control unit with attached 5251-11 terminals or 5256 printers. To an asynchronous host, terminals attached to the 6294 look like they are attached directly to the host.

The 6294 can be configured with six, 10 or 18 RS-232 ports. Prices range from $3,995 to $5,995.

Xpoint, 5600 Oakbrook Pkwy., Norcross, Ga. 30093.

Software

Communication Horizons has introduced **Netlib,** function libraries designed to provide record- and file-locking capabilities to Nantucket, Inc.'s Clipper Dbase III compiler running on a variety of networks.

Netlib is said to allow programmers to write programs allowing multiple users to have the same files open, but prevents users from updating the same records at the same time. Features include the ability to lock records and files; identify the logged-in user; and initiate or terminate network programming.

Netlib comes with object files, instructions and a sample application. Each version costs $99.

Communication Horizons, Suite 900, 701 Seventh Ave., New York, N.Y. 10036.

■

SCA Products and Services, Inc. has announced **Gateway PC Release 2**, the micro-to-mainframe link and mainframe data transfer product for IBM Personal Computers and compatibles.

The release adds IBM 3278, Forte and CXI, Inc.'s CXI-in-Irma compatibility mode to existing communication board support for Digital Communications Associates, Inc.'s Irma. Protocol support for Digital Equipment Corp. VT100, VT53, Xmodem and X.PC has been added to support for 3101.

Gateway PC Release 2 costs $210 to $350 per PC. Upgrades from earlier releases cost $50 per PC. The mainframe software for CMS and TSO costs $18,000.

SCA, 353 Lexington Ave., New York, N.Y. 10016.

Multiplexers/ Modems

Attachmate Corp. has unveiled **Attachremote 3270** connections for IBM-compatible personal computers.

The products are said to support four host sessions, printer emulation, IBM file transfer, 3270 Personal Computer API and S3G graphics using modem links to communicate with IBM mainframe processors.

The family consists of three models. FastSDLC uses a half-length card to connect to an external modem and supports line speeds to 19.2K bit/sec. It costs $645.

Autolink-48 integrates a 4.8K bit/sec. modem and autodialer with the IBM Synchronous Data Link Control adapter. It costs $1,995. Both come with 3270 remote station multisession software, which is available separately for $395.

Attachmate, 3241 118th S.E., Bellevue, Wash. 98005.

Racal-Vadic, Inc. has announced the **2400PA-SS** and the **2400PA-SH** synchronous SDLC- and HDLC-compatible, serial autodialer modems.

The modems connect directly to RS-232C communications ports. The modems can be controlled by a short autodialing applications program that runs under the existing communications software of the IBM Series/1 and System/36; the Digital Equipment Corp. VAX; the Hewlett-Packard Co. HP

NEW PRODUCTS/COMMUNICATIONS

3000; and other minicomputers.

The modems are priced at $795 each.

Racal-Vadic, 1525 McCarthy Blvd., Milpitas, Calif. 95035.

■

Fastcomm Data Corp. has announced the **Fastcomm 2496** modem.

The modem is said to support the Hayes Microcomputer Products, Inc.-compatible speeds of 1,400, 1,200 and 300 bit/sec., and V.29-compatible speeds at 9.6K bit/sec.

The modem is available as a stand-alone unit with an RS-232 connector for mainframe, mini and micro applications; as an internal half-card board that fits into an IBM Personal Computer expansion slot; or as rack-mount cards for mainframe applications.

Features include autodial and autoanswer capabilities and nonvolatile memory.

The Fastcomm 2496 is priced at $999.

Fastcomm Data, 12347-E Sunrise Valley Drive, Reston, Va. 22091.

■

Scitec Corp. has announced the **Saturn 15/20 T-Carrier Modem.**

The modem is said to come equipped with all I/O connectors, extensive timing modes. It is said to be able to perform encoding.

According to the vendor, the modem converts RS-422 V.36 signals to 1.544M bit/sec. or 2.048M bit/sec. with the optional CCITT G.703 interface.

The modem features independent, external, loop or station timing modes. It also offers front access to all controls.

The Saturn 15/20 T-Carrier Modem has a price tag of $1,450.

Scitec Corp., 850 Aquidneck Ave., Middletown, R.I. 02840.

■

Algo, Inc. has announced the **Algo MC610**, a statistical communications multiplexer said not to be restricted to simple point-to-point operation.

The MC610 is said to be able to have multiple composite data channels, permitting assembly of a network with up to 500 computers and terminals. Port-switching features allow RS-232 devices to dynamically connect to any other local or remote RS-232 device.

Concentration features make it possible for multiple terminals to communicate with a single local or remote computer port.

The MC610, with six ports, is priced at $1,495.

Algo, 9198-C Red Branch Road, Columbia, Md. 21045.

■

Artel Communications Corp. has added optical-fiber capability to its **Slimline** multiplexer family.

According to the vendor, the Artel Slimline multiplexers can now be configured with various combinations of coaxial, telephone wire and fiber-optic cable. They can use coaxial or fiber optics to multiplex up to 32 IBM 3270, Type A terminals over a single cable. They can be configured as point-to-point, multidrop or star systems.

The fiber-optic multiplexers, which allow eight to 32 terminals to be multiplexed over one dual-fiber cable, are priced from $950 to $2,250.

Artel Communications, P.O. Box 100, West Side Station, Worcester, Mass. 01602.

■

Microcom, Inc. has announced a line of **personal computer card modems**.

The modems, the PC/9624c, PC/2400c and the PC/2400 feature the Microcom Networking Protocol (MNP).

The PC/9624c is an asynchronous internal modem for the IBM Personal Computer, Personal Computer XT, PC AT and compatibles. It is capable of throughput up to 19.2K bit/sec. The PC/2400c is said to achieve throughput of 5K bit/sec. or higher over a 2,400 bit/sec. asynchronous link.

The PC/2400 can provide throughput of up to 2,900 bit/sec. over a 2,400-bit/sec. connection. All three employ MNP. They are single-slot, full-card modems and include standard phone line interfaces.

The PC/2400 costs $699; the PC/2400c costs $799; and the PC/9624c is priced at $1,749.

Microcom, 1400 Providence Highway, Norwood, Mass. 02062.

NEW PRODUCTS/COMMUNICATIONS

Local-area networks

Fox Research, Inc. has announced **10-Net 3.1**, the latest release of its local-area networking system.

Written to support the extended Microsoft Corp. MS-DOS 3.1 and 3.2 calls, 10-Net Version 3.1 is said to provide compatibility with the multiuser software applications written for the networking environment.

According to the vendor, the product offers expanded security features in menu-driven format. These features reportedly include directory security, group security and unique file ownership.

Other features of 10-Net are said to include enhanced printer spooling and dynamic drive sharing.

10-Net comes with an interface card, software, tap box, cable and manual.

The networking system costs $695.

Fox Research, 7016 Corporate Way, Dayton, Ohio 45459.

■

Information Technologies, Inc. has announced the **Linkup Gateway System**, Net Bios-compatible gateway software options said to support the IBM PC Network, IBM's Token-Ring network, Fox Research, Inc.'s 10-Net and 3Com Corp.'s local-area networks (LAN).

The gateway system option allows the connection of personal computers to existing IBM Systems Network Architecture (SNA) or Binary Synchronous Control networks without necessitating system changes or 3274 controllers, according to the vendor.

Data communications is provided between personal computers attached to a LAN and an IBM or compatible host computer as multisession terminals. Up to 32 sessions are available for concurrent use.

A full SNA LAN/Gateway, with hardware, costs $1,990.

Information Technologies, 7850 E. Evans Road, Scottsdale, Ariz. 85260.

Network services

Atlantic Research Corp. has announced an on-line application program library for test equipment users called **ARC Access.**

The service is an application program library service that connects users of Atlantic Research's Interview line of test equipment to the source of IBM Systems Network Architecture, CCITT X.25, Bisync and other application programs available. Users can download programs and documentation.

ARC Access can be accessed by an Atlantic Research Data Analyzer or ASCII terminal device and a 1,200 bit/sec. asynchronous modem.

The service is available free of charge.

Atlantic Research, 5390 Cherokee Ave., Alexandria, Va. 22312.

Test equipment

L-Com Data Products has introduced its model **DG-005** RS-232 breakout box.

The self-contained monitor and breakout box is said to have everything needed to test I/O conditions. Except for pin 1, all 24 lines can be switched open or closed. Any line can be interconnected by using jumper wires.

Twelve two-color LEDs monitor lines 2 through 6, 8, 15, 17, 20, 21, 22 and 25 with two spares. The unit is powered by two 9-volt batteries.

The DG-005 is priced at $189.95.

L-Com, 1755 Osgood St., North Andover, Mass. 01845.

Auxiliary equipment

B&B Electronics Manufacturing Co. has announced the **B&B RS-232C-to-RS-422A converter.**

The converter uses balanced differential signals to permit communications on cable lengths up to 4,000 ft with bit rates up to 90K bit/sec. When used with multidrop systems, the converter allows up to 10 receivers to be connected to a driver at once, according to the vendor.

The converter is priced at $49.95 including a male DB25P connector for RS-232C and a female DB25S connector for RS-422A. An alternate Reversed Converter is available with a female DB25S connector for RS-232C interface and a male DB25P for RS-422A for $49.95.

B&B Electronics, 1500P Boyce Memorial Drive, Ottawa, Ill. 61350.

NEW PRODUCTS/SYSTEMS & PERIPHERALS

SYSTEMS & PERIPHERALS

Turnkey Systems

Datachecker Systems, Inc. has unveiled the **Series 3000** point-of-sale (POS) systems based on a 32-bit microprocessor.

The Series 3000 is said to be fully programmable. It is based on intelligent POS terminals and an optional controller. The Shared Terminal Applications Resource (STAR) controller provides reporting, data base maintenance, communications/credit, systems network interface and file server functions. Up to 127 Series 3000 terminals can be connected to a STAR controller.

The terminal is available in either an integrated or modular design and comes with expandable memory and storage, terminal data base and retail transaction set. Each terminal can support up to 32 peripherals.

The Series 3000 integrated model costs $3,640. The modular terminal costs $3,995.

Datachecker, P.O. Box 58090, 2900 Semiconductor Drive, Santa Clara, Calif. 95052.

Processors

Unbound, Inc. has introduced the **Dataqube 100** and the **Dataqube 103**, Digital Equipment Corp.-compatible computer systems.

The Dataqube 100 includes a four-quad slot backplane, dual RX-50 floppy and a 51M-byte disk drive. It features an 11/23 or 11/73 CPU, floating-point processor, RT-11 operating system, 512K-byte memory and a customer-defined data acquisition board package.

The Dataqube 103 incorporates the same features with an enhanced small-device interface 170 or 380M-byte disk drive.

Prices start at $8,995.

Unbound, 15239 Springdale St., Huntington Beach, Calif. 92649.

■

Bicc-Vero Electronics, Inc. has announced a **family of single board computers** in single and dual high-mounting style.

The VMEbus-compatible data processing modules, compatible with Motorola, Inc.'s VMEbus, feature a Motorola 68000/68010 processor operating at 10 MHz and a 128K-byte erasable, programmable read-only memory.

According to the vendor, other attributes of the series of single board computers include a 512K-byte zero-wait state, local random-access memory, two serial ports and a seven-level interrupt handler.

Prices start at $572.

Bicc-Vero Electronics, 40 Lindeman Drive, Trumball, Conn. 06611.

■

Harris Corp. has announced the **Emitter-Coupled Logic** (ECL) shared-memory system designed to allow Harris superminicomputers to support high-performance memory boards in a multiprocessing configuration of up to 12 Harris 1200 systems.

According to the vendor, the system features an 80M bit/sec. bandwidth.

Other atttributes included are cycle and access times said to be 30% to 50% faster than Harris's other shared-memory systems.

The ECL shared-memory unit is priced at $27,500.

The port kit required for each processor in the configuration is priced at $22,500.

Harris, 2101 W. Cypress Creek Road, Fort Lauderdale, Fla. 33309.

■

DY-4 Systems, Inc. has announced the **SVME-103**, a single-board VMEbus computer.

Processing power is provided by a 10-MHz Motorola 68010 CPU with a 68881 floating-point processor.

The 512K bytes of on-board, dual-ported memory can be accessed with zero-wait states and offer parity

Continued on page 140

NEW PRODUCTS/SYSTEMS & PERIPHERALS

Continued from page 139
error detection.

Other attributes of the one-board system controller include a multilevel bus arbiter, system clock generator and bus monitor.

According to the vendor, the SVME-103 is priced at $2,423.

DY-4 Systems, Suite 202, 1475 South Bascom Ave., Campbell, Calif. 95008.

■

Micro Memory, Inc. has announced the **MM-7250D** dual-ported, Multibus/ILBX/HSI memory board.

The board is said to have a maximum capacity of 4M bytes.

The ILBX port can operate in either the synchronous or asynchronous mode with zero-wait states when used with the ISB286/10A or ISBC286/12 8-MHz microcomputers.

The MM-7250D is also said to be compatible with systems employing the Intel Corp. 80286 or 80186 microprocessor or the Motorola, Inc. 68000 microprocessor.

According to the vendor, the product features an error status register for detecting parity errors on the multibus bus.

Memory is available in 512K bytes, 1M byte, 2M bytes and 4M bytes.

The 4M-byte version is priced at $1,550.

Micro Memory, 9540 Vassar Ave., Chatsworth, Calif. 91311.

■

Force Computers, Inc. has introduced its **SRAM-3** VMEbus/VMXbus memory board for Motorola, Inc. VMEbus systems.

The SRAM-3 memory board offers either 512K bytes of dual-port static random-access memory (RAM) or 1M byte of dual-port static RAM.

According to Force Computers, the VMEbus interface includes 24- and 32-bit addresses as well as 8-, 16- and 32-bit data.

The VMXbus interface is the standard A24 and D8, D16 and D32.

The vendor reports unaligned transfers and read-modify writes are supported on both buses.

The VMEbus board features an average write access time of 80 nanosecond and an average read access time of 210 nanoseconds.

Other attributes of the board include an average write access time of 70 nanoseconds and an average read access time of 210 nanoseconds.

The 512K-byte SRAM-3A and the 1M-byte SRAM-3B are priced at $2,650 and $4,150, respectively.

Force Computers, 727 University Ave., Los Gatos, Calif. 95030.

Graphics systems

Tektronix, Inc. has announced the **4100F3F Field Kit**, an interactive direct memory access (DMA) interface for its 4120 series workstations.

The interface is said to allow single-path, interactive communication at parallel DMA speeds between the 4120 series system and a host computer.

The first interface available was designed for use with Digital Equipment Corp.'s MicroVMS-based Microvax II.

Including the hardware for the DMA on a 4120 system, a DRV-11WA interface card, internal cables and connectors for the Microvax, a software driver for installation under MicroVMS and the parallel interface cable that connects the two systems, the 4100F3F is priced at $3,995.

Tektronix, P.O. Box 1000, Wilsonville, Ore. 97070.

Data storage

Scientific Micro Systems, Inc. has announced the **SMS 0108 controller** for fixed disks, floppy disks and tape.

The SMS 0108 was designed for Digital Equipment Corp.'s Microvax II and LSI-11 CPUs. It supports enhanced small device interface- and ST506/412-compatible Winchester disk drives. It uses an enhanced version of Mass Storage Control Protocol to communicate with Winchester and floppy drives and an enhanced version of tape MSCP to communicate with QIC-02 ¼-in. cartridge tape drives. Features include four direct memory access channels; command queuing of up to eight I/O commands; on-board error correction code logic; and overlapped seeks for multidrive configurations.

The 0108 costs $1,150.

Scientific Micro Systems, 339 N. Bernardo Ave., Mountain View, Calif. 94043.

NEW PRODUCTS/SYSTEMS & PERIPHERALS

MDB Systems, Inc. has introduced a family of **Removable Mass Storage** subsystems for users of Digital Equipment Corp. Q-bus, Unibus, VAX and Microvax II computers.

According to the vendor, the Removable Mass Storage series provides the removability and vibration protection of the peripheral devices.

The subsystems provide a combination of two peripheral devices, which can be any combination of two 5¼-in. disk drives or a disk drive with a TK50 tape or RX50 floppy backup.

A total of 620M bytes can be supplied.

An integral power supply is included, according to the vendor.

A Removable Mass Storage with two devices and controllers is priced from $14,723.

MDB Systems, Box 5508, 1995 N. Batavia St., Orange, Calif. 92613.

Dual Systems Corp. has announced its VMEbus small computer systems interface (SCSI) controller, **VSCSI**.

The VSCSI is a single-board computer with an intelligent direct memory access-driven peripheral controller.

The VSCSI controller is capable of controlling eight SCSI initiator or target devices such as cartridge tape drives, hard and floppy disks, optical memories and printers.

The board features 512K bytes of local dual-ported random-access memory and up to 64K bytes of erasable programmable read-only memory. It supports the 1.5M bit/sec. asynchronous data rate.

According to the vendor, with the addition of a serial port board, the VSCSI can perform as a computer and serve as a VMEbus master.

The VSCI is priced at $1,785.

Dual Systems, 2530 San Pablo Ave., Berkeley, Calif. 94702.

■

Distributed Processing Technology has added the **PM3010/70 ESDI Caching Disk Controller** to its PM3010 Series of small computer systems interface Caching Controllers.

Four enhanced small device interface (ESDI) drives with data rates up to 20 MHz may be controlled with a 5¼-in. extended form factor board. The PM3010/70 is said to support both hard sector and soft sector ESDI drives with up to 256 heads and 4,096 cylinders. It provides fully automatic disk formatting upon receipt of a single command from the host computer.

Features include automatic medium defect management, automatic flushing and the ability to prefetch and lock specific blocks into cache.

The PM3010/70 ESDI is priced at $940.

Distributed Processing Technology, P.O. Box 1864, 132 Candace Drive, Maitland, Fla. 32751.

■

Bering Industries, Inc. has announced the **Multipac 60**, a removable Bernoulli and hard-disk subsystem designed for use with Hewlett-Packard Co. computers.

The Multipac 60 features an 8-in., 20M-byte removable Bernoulli cartridge with built-in, 40M-byte fixed hard-disk storage. It is said to be plug-compatible with HP CS/80 and SS/80 computers.

The Multipac 60 costs $6,790, including one 20M-byte Bernoulli cartridge. Additional cartridges are priced at $95.

Bering Industries, 1400 Fulton Place, Fremont, Calif. 94539.

Terminals

Datachecker Systems, Inc. has introduced the **2200 Keyscan System**, a point-of-sale terminal designed to move from one-key entry to scanning.

According to the vendor, users can take the 2200 Keyscan system from a single, stand-alone terminal to a fully configured, multilane scanning system backed up by a microcomputer.

Attributes of the system include the ability for software to manage up to 100,000 price lookups and respond to them at a rate of 300 lookups per min.

The Datachecker Systems 2200 Keyscan System is priced at $2,300 for the key entry unit.

Datachecker, P.O. Box 58090, 2900 Semiconductor Drive, Santa Clara, Calif. 95052.

NEW PRODUCTS/SYSTEMS & PERIPHERALS

Compuscan, Inc. has announced the **Compuscan Model 245 PCS Page Reader**, a combination text and image scanner for IBM Personal Computers, XTs, ATs and compatibles.

The Model 245 is said to automatically read, digitize and transfer pages of typewritten text and images, such as line art, charts, graphs, logos and signatures, to personal computers. As many as 50 pages at a time reportedly can be stacked for automatic feeding.

According to the vendor, images are scanned at resolutions of 200 or 300 dots/in.

Images can be bit-edited, rotated, annotated, moved, cropped, shaded, repeated and merged with text.

The Compuscan Model 245 PCS is priced at $3,995.

Compuscan, Building 2, 81 Two Bridges Road, Fairfield, N.J. 07006.

Xpoint Corp. has announced its **Remote-91** IBM 5291 or 5251 keyboard compatible terminal.

The Remote-91 is said to be an ASCII terminal that can be used with most protocol converters to access IBM System/34, 36 and 38 computers.

The Xpoint Remote-91 terminal.

It comes standard with either 5251-11 or 5291 keyboard configurations.

Remote-91 features a five-line, 80-column screen and has main and auxiliary ports that are RS-232 compatible and can transfer data at up to 19.2K bit/sec.

The Remote-91 terminal is priced at $849.

Xpoint, Suite 130, 5600 Oakbrook Pkwy., Norcross, Ga. 30093.

■

Honeywell, Inc. has announced a **memory and battery backup** option for its Series 5000 factory data collection terminals for use on the DPS 6 series of Honeywell minicomputers.

The option is said to provide continuous operation at the terminal level.

It offers 40K bytes of available internal memory to store data in case of a local line disconnect or host downtime. Local programming capability is also available.

The unit is said to automatically sense the disconnect and reconnect function and switches to the local program mode.

The battery backup feature allows normal operation of the terminal for up to three hours, according to the vendor.

The data entered and stored will be retained for up to seven hours.

The memory and backup option is priced at $1,000.

Honeywell, 2222 W. Peoria Ave., Phoenix, Ariz. 85029.

Printers/Plotters

Interface Systems, Inc. has released the **ISI 525**, an IBM System/34, 36 and 38 plug-compatible desktop dot matrix printer.

The printer is said to feature bar coding capabilities, a demand-document tear bar and a dual twin axial/Centronics Data Computer Corp. parallel port for connection to IBM Personal Computers.

ISI 525 dot matrix printer.

The ISI 525 prints at 400 char./sec. in draft mode and 100 char./sec. in near-letter quality on continuous-feed forms, labels, tags and tickets. Character spacing can be 10 or 16.67 char./in.

The ISI 525 is priced at $4,950.

Interface Systems, 5855 Interface Drive, Ann Arbor, Mich. 48103.

■

JDL, Inc. has announced the **850 EWS, 850 EWS/GL** and the **850 EWS with GL Processor Controller**, a series of color printer/plotters designed for engineering workstations.

The 850 series provides 14-color plotting. The 850 EWS has a plot speed of 24 in./sec. at a resolution of 90 by 90 dot/in. or 12 in./sec. at 180 by 180 dot/in. It accepts media up to 18 in. wide and offers five standard fonts in print mode.

The JDL 850 EWS/GL offers the same features as the 850 EWS and Hewlett-Packard Co.'s Graphics Language (HP-GL) compatibility as well as standard serial and parallel ports. The 850 EWS with GL Processor Controller has all the features of the 850 EWS in addition to HP-GL compatibility and vector file conversion, which are performed by an external controller.

The 850 EWS costs $2,495. The 850 EWS/GL costs $3,495 and the 850 EWS with GL Processor Controller costs from $3,495 to $3,895, depending on the amount of memory.

JDL, Suite 104, 2801 Townsgate Road, Westlake Village, Calif. 91361.

Western Graphtec, Inc. has announced an A/B-size desktop plotter called the **PD 9311/F.**

The 9311/F is a 4-pen pinch roller plotter featuring an automatic paper feed capable of handling up to 100 sheets at a time. It is said to have a maximum plotting speed of 18 in./sec.

Both the Graphtec Protocol Graphics Language and the Hewlett-Packard Co. Graphics Language emulation commands are available. The PD 9311/F is said to interface with any type of computer via either an RS-232, IEEE or 8-bit parallel interface.

The PD 9311/F costs $3,295.

Western Graphtec, 12 Chrysler St., Irvine, Calif. 92714.

■

Hewlett-Packard Co. has announced the **HP 2563B** dot matrix impact line printer.

The 300 line/min. printer prints at 140 by 144 dot/in. It features a print stand, sound enclosure and passive paper stacker, according to the vendor.

HP also announced a QMS-compatible label-formatting option. Attributes of this formatting option include enhanced bar-code, graphics and labeling capabilities for dot matrix printers.

The HP 2563B is priced at $7,350. The HP Label Card is priced at $2,120.

Hewlett-Packard, 1820 Embarcadero Road, Palo Alto, Calif. 94303.

Power supplies

Nova Electric, Inc. has announced its **10KVA** Uninterruptible Power System.

The 10KVA system employs a modern transistor technology in a six-step waveform design.

Standard features include a static transfer switch and a maintenance bypass switch, according to the vendor.

The system also comes with a complete diagnostic package that monitors all functions and displays status on the front of the unit.

Designed for data processing applications on IBM System/38 and Digital Equipment Corp. VAX computers, the 10KVA system can also be used on process control systems, boiler control systems, security systems and communciations systems.

The 10KVA costs $20,600.

Nova Electric, 263 Hillside Ave., Nutley, N.J. 078110.

■

Isoreg Corp. has introduced the **056 Series** of three-phase pulse-width modulated Isoguard uninterruptible power systems.

The 056 Series is available in 20, 30, 40 and 60 kVA power ratings.

Each power system features pulse-width modulation SCR power-inverter technology, according to the vendor.

A supervisory monitor panel that displays more than ten operational parameters, including battery status, data on the rectifier, inverter and output power is included.

Other attributes include a two-way automatic electronic bypass switch and a manual bypass.

The units offer bottom-through-top ventilation and have cabinet-floor cable access.

Prices for the 056 Series of power systems range from $34,000 to $40,000.

Isoreg, P.O. Box 486, Littleton, Mass. 01460.

PRICE REDUCTIONS

ITT Courier has lowered the prices on some of its IBM 3270-compatible displays, controllers and printers.

The ITT 9210, 9212, 1700 and 1778 displays were reduced from the previous price of $1,595 to $1,295.

Prices for basic models of the ITT 9440 local controllers were also lowered.

The minimum configuration now supports 18 devices at a price of $9,100, according to the vendor.

The ITT 9306 color matrix printer is now priced at $6,700.

ITT Courier, 1515 W. 14th St., Tempe, Ariz. 85281.

■

Reality Technologies has announced a reduction in the price of its **Business Simulator** software package.

The software uses a computer-based model to reflect a real-life business environment.

It is said to help teach business lessons in a risk-free simulation, which allows the user to create and simulate the business life cycle of a start-up company.

Business Simulator requires an IBM Personal Computer or compatible with 256K bytes of random-access memory, according to Reality Technologies.

It is priced at $69.95.

Reality Technologies, 3624 Market St., Philadelphia, Pa. 19104.

■

Tecmar, Inc. has reduced the price of its **Maestro** multifunction board for the IBM Personal Computer AT and compatibles.

The Maestro AT can be configured with up to 2.5M bytes of random-access memory.

It also provides standard serial and parallel ports, according to the vendor.

It comes with Tecmar's Chest of Software package including 20 business and productivity programs including inventory control, a memo writer and print spooler.

Maestro AT with zero K bytes of memory is now priced at $529.

Tecmar, 6225 Cochran Road, Solon, Ohio. 44139.

Executive Report

Welcome to our world

By PATRICK J. MCGOVERN

As I reflect upon the birth of *Computerworld* 1,000 issues ago, I can't help but also reflect upon the state of the computer industry 1,000 weeks ago. The year was 1967, and the topics of the day were vastly different from those issues that command our attention almost 20 years later.

Then, as now, *Computerworld* is at the helm, answering the information systems executive's demands for information in a vast array of areas.

Although the industry has not always agreed with our tone or manner of reviewing products and services, our mission has always been to be an advocate for our readers. We strongly believe that everyone's best interests are served when we speak on behalf of the user.

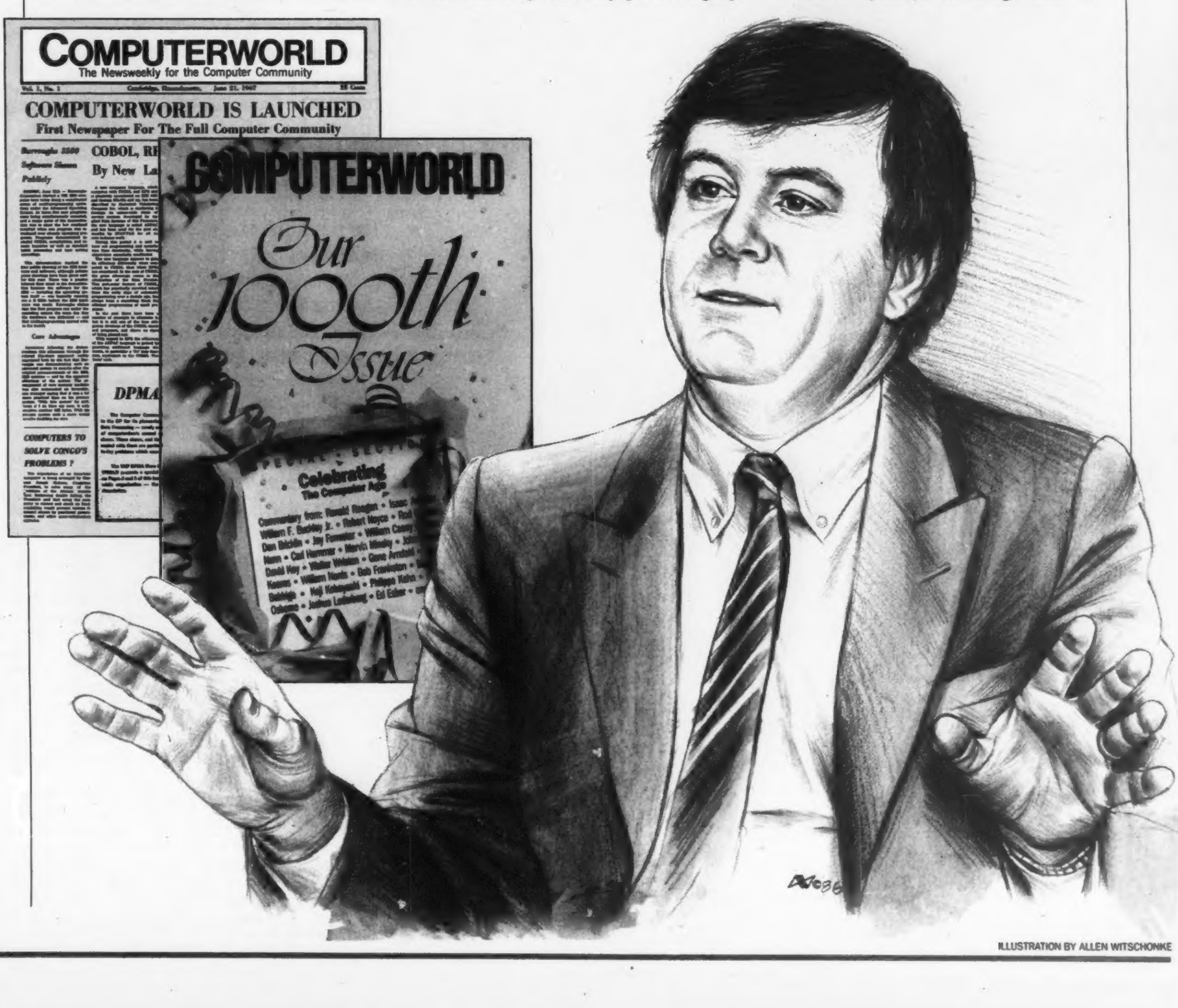
As *Computerworld*'s readership has increased — we now reach more than half a million MIS professionals in the U.S. alone — so, too, has the scope of our coverage. We are not confined to covering one particular industry segment or product line. As advanced technologies and computing solutions have come to the forefront, *Computerworld* has responded by providing up-to-date information not only on mainframe trends but also on minicomputers, office automation, communications, microcomputers and so on.

Clearly, the information technology industry is much more complex today than it was when *Computerworld* was launched. And as a result, the responsibilities of executives charged with managing the use of technology are much broader.

MIS has been forced to rethink its mission. Corporate computing is no longer restricted to data center management. The effective use of small-system technology is now the single greatest information processing challenge for the 1980s.

The emphasis on the use of small systems has changed not only the information systems challenge but also

McGovern, founding publisher of Computerworld, *is chairman of International Data Group, the parent company of International Data Corp. and C.W. Communications, Inc. He is board chairman of CWCI, the publishing group that includes* Computerworld *and more than 70 computer publications in 28 countries.*



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the political balance of power. With end users' systems now accounting for the majority of overall systems spending, it is hardly surprising that debates about responsibility and authority have emerged.

Until the last few years, such challenges were impossible. In the 1960s and 1970s, the MIS professionals were the high priests of computing. Even the proliferation of minicomputers did not seriously threaten the MIS hegemony.

With the arrival of the personal computer, all of this changed. Today, there are some 12 million PCs in use in U.S. businesses, and about one-third of our white-collar work force now works with some sort of intelligent device.

End users are now getting first-hand experience with creating applications, data bases, communications links and the like. An increasing

”

The effective use of small-system technology is now the single greatest information processing challenge for the 1980s.

number have a very good understanding of their systems and applications. This has had several key effects.

End users are becoming much smarter MIS customers. They no longer readily accept MIS statements that something "can't be done" or will take "at least six months." Additionally, users have begun to get a sense of what certain types of computing actually cost. Thus, MIS chargeback practices are, for the first time, beginning to be intelligently evaluated. MIS executives will increasingly have to compete for business.

On the bright side, end users are better able to understand DP's problems. End-user computing often consumes a great deal more time than originally planned, while products such as local-area networks have taught end users the hard facts about ease of use, documentation, support, training and, most of all, vendor claims.

With these management and end-user views in mind, it becomes clear that the MIS executive has to do two things in order to increase his value to his organization.

First, MIS must increase its understanding of the corporate mission. If a company is considering an acquisition, how will both companies' DP operations affect the ability to offer integrated products? If an organization wants to do business with a foreign supplier, how can MIS speed the efficient exchange of information? These are the types of high-level decisions a chief information officer should, and will, be part of.

Second, MIS must recognize and take advantage of technological change. The effective use of PCs must be among the top priorities, not something to which MIS provides lip service.

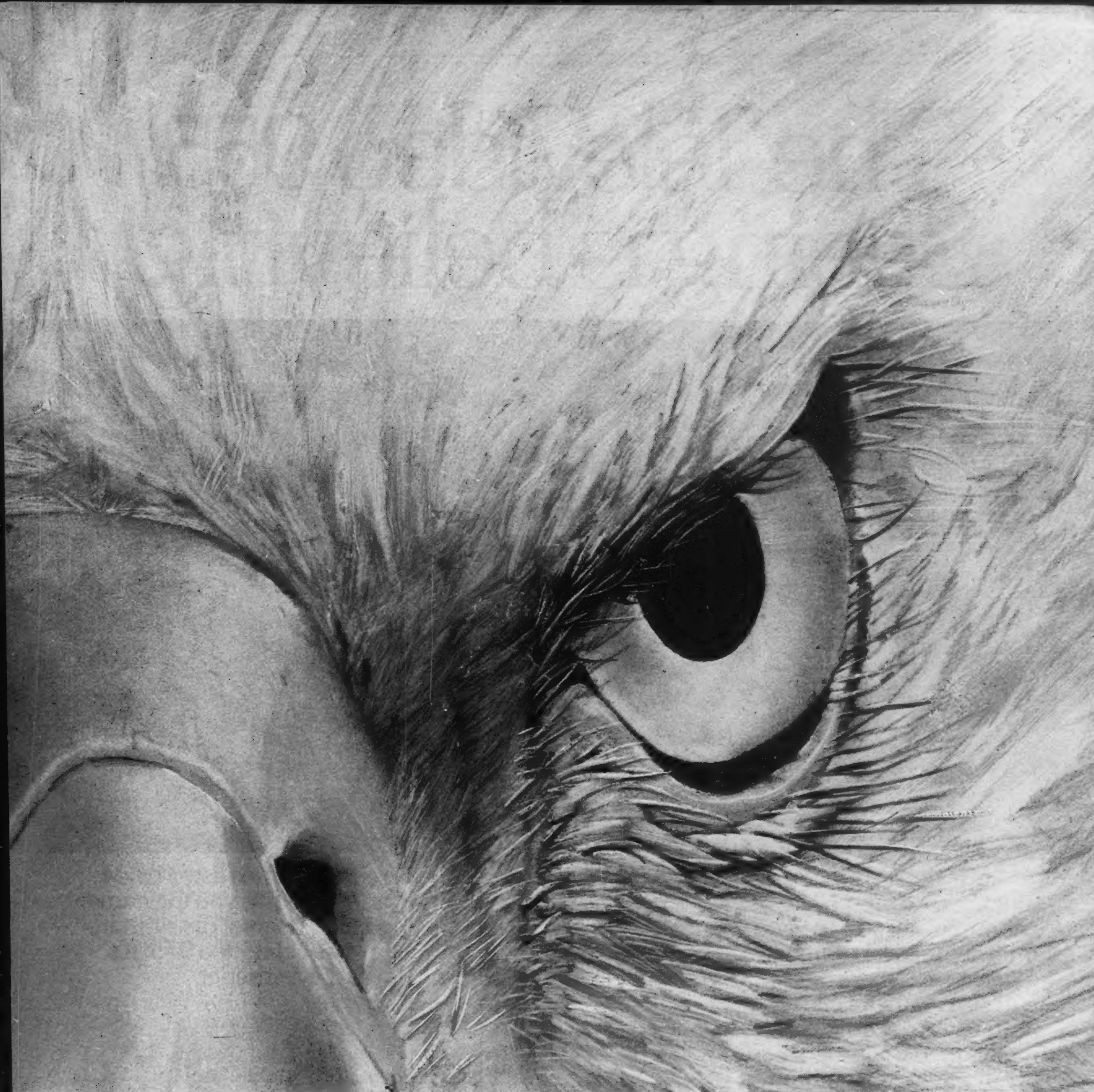
If end users do not perceive MIS as a valued partner in managing end-user computing operations, they will go their own way, and MIS professionals will face diminished career prospects.

The great task for MIS professionals is to assume these new roles while continuing to effectively manage their already heavy work loads. *Computerworld*'s mission is to help them in that process by providing information that is relevant to their planning needs on both the strategic and technical levels.

he challenges that our industry faces today are part of the process of building a worldwide infrastructure. Relatively simple products such as automobiles and telephones have been with us for nearly a century, yet in many parts of the world there are still no roads or phones. Computers have been on the scene for only about 40 years, and thus there is no doubt that much work remains to be done. But in our view, there is even less doubt that all the work will prove worthwhile.

Computerworld stands at the forefront. Twenty years ago no one could have foreseen that within five years *CW* would become the largest computer industry publication and within 10 years the largest publication in a specialized business or trade field.

It is clear to the global business community that the importance of successfully managing information grows more imperative each day. *Computerworld* is ready to work in a partnership with the MIS executive to help make this a reality. ■



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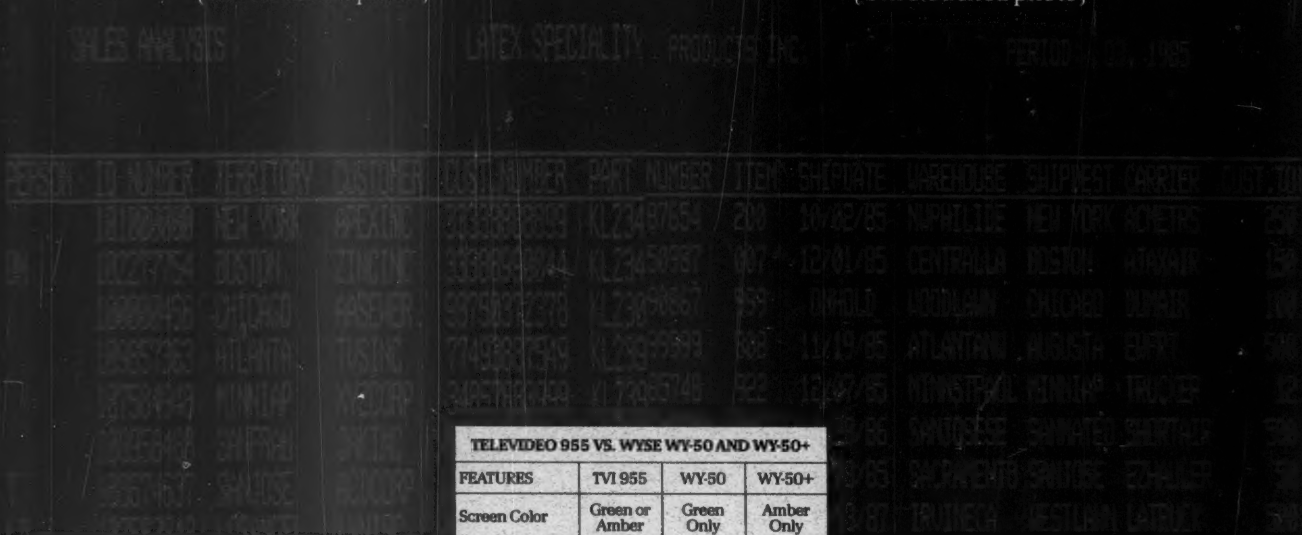

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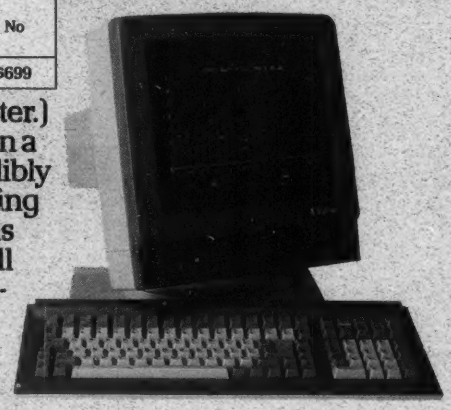

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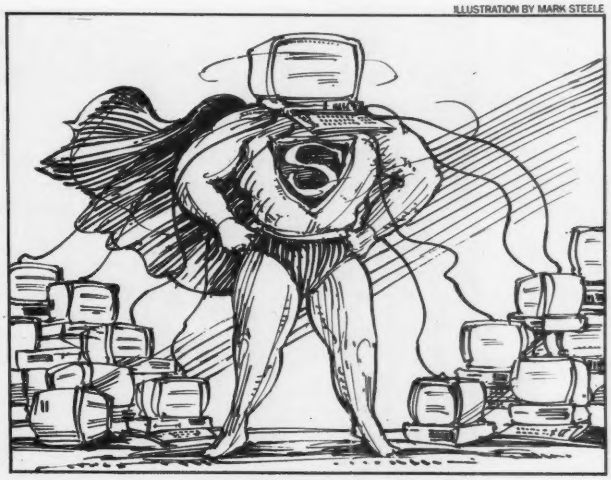
Getting information to the end users

ILLUSTRATION BY MARK STEELE



By JAMES A. MARTIN

Corporate America is slowly awakening from a hardware hangover.

Throughout the 1980s, millions of dollars have been spent on mainframes to house the corporate data bases and on microcomputers to appease the processing demands of end users, all in the name of efficiency and automation.

As microcomputers became more powerful, end users became more vocal about accessing the wealth of information stored on the host computer to enhance their own reports. The MIS initiative of the past two years has been to wade through incompatible operating systems and various micro-to-mainframe link solutions in the hope of finding a reasonably simple communications path that would satisfy both camps.

With all that disparate hardware in place, the solutions emerging today, and in the future, are focusing on sophisticated software programs to bridge those complex and frustrating gaps.

The paths chosen can be as diverse as the companies implementing them, but there is one area of agreement for analysts and vendors alike — software programs will become more oriented toward distributed processing systems that feature built-in, largely transparent micro-to-mainframe links. As a result, the basic micro-to-mainframe program, such as terminal emulation software and hardware, will soon be history.

Not everyone believes there are many end users who need access to data bases.

In the late 1970s, only 6% to 7% of business professionals in this country were accessing mainframe data, generally through time-sharing systems and terminals, according to Richard L. Crandall, president and chief executive officer of Comshare, Inc., an Ann Arbor, Mich., software vendor.

The microcomputer in the early 1980s was mainly used for stand-alone processing and was without adequate links to the host. "The first generation of micro-to-mainframe links were too trivial and didn't solve the problem," Crandall says. "They got you across the telephone lines, but they didn't really get you into a data base."

Although micro-to-mainframe software and hardware links have become more sophisticated, they are not in themselves a means to an end. "Those links are not economically feasible with the costs of leased or dial-up lines," says Kimball Brown, industry analyst for Dataquest, Inc. in San Jose, Calif.

"The reason many companies bought those links was that for years they had these terminals, and then they began swapping them for PCs that they still wanted to run in the terminal mode," Brown says. "But if they are trying to tie those PCs together, they are going to have to find a more economic means."

The function of micro-mainframe links will eventually be absorbed by distributed processing software systems that cross hardware boundaries between micros, departmental processors and mainframes, according to Crandall.

"The micro-mainframe link will become a function of another piece of software and not really exist as a stand-alone product," he says.

"The market for stand-alone links will be zero, but the market for software programs with those functions inherent will be very strong. Distributed data base technology performs what end users originally wanted micro-to-mainframe links to do," says Gary Morgenthaler, president of Relational Technology, Inc. in Alameda, Calif.

Enables end-user access

"The open architecture of a distributed data base allows the building of a corporate data base and enables an organization to access information from any computer with no knowledge of the application required by the end user," he adds.

Before the advent of distributed processing, corporations often had to grapple with each department using a different software system that was most appropriate for its own applications, Morgenthaler says.

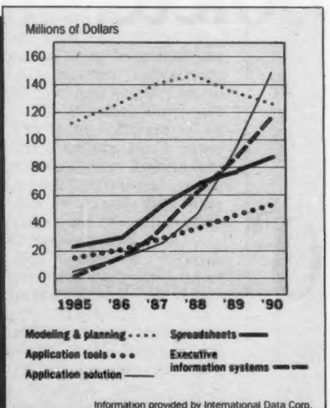
"Now, companies are trying to adopt a small number of software products as standards across the organization. That

facilitates the ability of end users to access data throughout the company in an integrated system," he adds.

Most software systems in the future will have distributed applications as matter of economics, Crandall maintains. "The mainframe is too expensive to use for some functions that can be done on the micro,

DECISION SUPPORT SYSTEMS: MARKET FORECASTS BY TYPE

JEFF BABINEAU



Information provided by International Data Corp.

and the micro is not powerful enough to be a central depository for a data base. If there's a distributed processing solution to a DP problem, and it competes with a mainframe-only solution, the distributed solution is going to win."

At present, there are few software programs that provide this kind of distributed solution, Crandall says. "It takes years for companies to work these into their major systems. But down the road, most new applications will be distributed because of the economics involved."

Many DP/MIS managers are uncomfortable with end users having direct access to the mainframe data base, a situation that has boosted three-tiered processing architectures. Says Crandall: "DP or MIS will not want the unpredictable demand patterns of large user populations accessing the mainframe corporate data base directly, so instead they will want to extract the data out of the data base, put it into another file on another machine and let end users access it from there."

Indeed, end-user demands can often be quite unpredictable. At Computer Sciences Corp. in San Diego, end users working on IBM Personal Computer XTs and ATs recently began using Relational Technology, Inc.'s Ingres/PC Link to retrieve data from the Ingres relational data base management system residing on Digital Equipment Corp. VAX 8600 and 11/785 minicomputers.

Initially, Computer Sciences end users wanted to download payroll and ordering information to massage into Lotus Development Corp. 1-2-3 spreadsheets for departmental reports, according to Tom Vollmer, manager of the Ingres and AT&T Unix applications. But before long, those end users began to catch discrepancies between mainframe and spreadsheet data.

For example, an end user might put in an order for an IBM Personal Computer. Four weeks later, he discovers from the mainframe data base that his department has been billed twice for it.

"Before, he might not have caught the error, because fewer people have access to the paper invoices," Vollmer says.

As a result, end users began to keep "two sets of books," one with their department records and one with mainframe data, which led to requests for capabilities beyond simply accessing the host, Vollmer relates. They now use the Ingres/PC Link to retrieve host information and drop it into 1-2-3 spreadsheets, something that Vollmer calls "distributed access."

As any market of technology matures, it becomes driven more by software than hardware, says Jocelyn Young, an analyst with Future Computing, Inc. in Dallas. Future Computing predicts terminal emulation board sales will decline from $725 million in 1988 to $645 million in 1990, and micro-mainframe links will increase from $310 million to $638 million over the same period.

Those links will not be the stand-alone type commonly thought of today, however, she adds. "Most of them will be bundled into a system unit that you won't be aware of. They will be packaged differently."

Personal computer and host software applications in the future will have a much tighter integration between them, which in turn will stimulate demand for those software links, Young says.

"Cooperative processing between the PC and the host will not only distribute the processing, but it will enable the PC and the host to interact as peers rather than master and slave," she adds. IBM's Advanced Peer-to-Peer Communications protocol should emerge as a standard, spurring acceptance of advanced micro-to-host applications.

> ***'The first generation of micro-to-mainframe links got you across the telephone lines, but they didn't really get you into a data base.'***
>
> **— Richard L. Crandall**
> **Comshare, Inc.**

"By 1990, those PC-to-host connections won't be viewed as a bridge between two foreign worlds and as a battle between MIS and the end user," Young predicts. "Instead, they will be more of an integral part of a homogeneous, cooperative and very versatile network configuration in a three-tier or four-tier environment."

Although many companies see the logic in allowing end users to download corporate data, there are equally as many that don't want those users uploading.

Continued on page 155

"Our philosophy is to have the main processing of our systems on the mainframe and to continue to process centrally," says Larry Lammers, project administrator for the Inland Container Corp. in Indianapolis. "We just don't see the need to offload work to the PC, then upload it back to the mainframe for further processing."

Inland's end users next year will be able to create their own IBM 3033 files, combine data from multiple files, perform extractions and download those files to an IBM Personal Computer XT by using Software AG of North America, Inc.'s Super Natural, a query system into the Adabas/Natural mainframe relational data base system and fourth-generation language tool.

Not everyone believes there are many end users who truly need to access data bases. "There is a myth," says Peter Kibler, senior consultant with International Resource Development, Inc. in Norwalk, Conn., "that there is this large amount of data stored on mainframes and that all we need to do is tap into it and we are home free.

'Timely basis'

"I tend to believe that most large data bases are generating reports on a timely basis, and there's really no need for end users to access the mainframe data base."

Kibler says the emerging compact disk/read-only memory (CD-ROM) technology could provide a safe and economic method of bringing the corporate data base to the end user. "Information providers are carefully looking at putting a data base on a CD-ROM platter and distributing that weekly or monthly," he says.

"If there's a need for real-time access, the end user could use the CD-ROM disk for all the data up to about two weeks ago and then access the last two week's worth from the mainframe. It would still save time in search and retrieval."

With the growing sophistication of end users and the increased need to provide them with mainframe data, some programmers are interested in developing new applications with the end user's help, according to Dennis Yablonsky, president and chief operating officer of Cincom Systems, Inc. in Cincinnati.

"End users would develop with the programmer the fields and the logic they need in order to query against and gain access to the corporate data base," Yab-

Continued on page 156

'By 1990, those PC-to-host connections won't be viewed as a bridge between two foreign worlds and as a battle between MIS and the end user. They will be more of an integral part of a homogeneous, cooperative and very versatile network configuration.'

— Jocelyn Young
Future Computing, Inc.

Continued from page 155

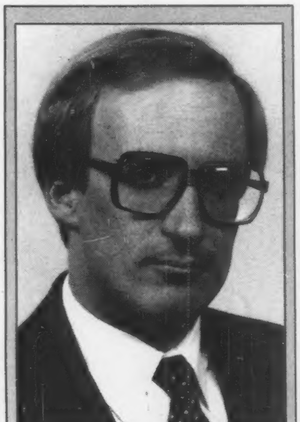
lonsky says. "Together, they come up with a prototype of an application that the end user tests. That way, the application is built quicker and better."

Furthermore, sophisticated relational query languages with ease-of-use front ends will enable end users to generate applications of their own, without the involvement of DP and MIS managers, according to Yablonsky.

As the software is fine-tuned, it will better handle the security concerns most MIS managers have today, Yablonsky believes. "It will still be an emotional concern, but the technology is there to deal with the problem," he says.

Using what's available

The bottom line to the growth of peer-to-peer and distributed process-



'Together, the programmer and end user come up with a prototype of an application that the end user tests. That way, the application is built quicker and better.'

— Dennis Yablonsky
Cincom Systems, Inc.

ing applications, Future Computing's Young believes, is the need to use what is already available.

"There is already a substantial amount of hardware out there, so the key to the growth of PC-to-host applications is to accommodate the existing hardware and software, while still allowing for growth."

Budget-minded corporations should appreciate that philosophy, and it's one MIS strategists should have no trouble adopting.

"DP people," International Resource Development's Kibler adds, "are ad hoc oriented. They like to add to what they already have." ■

User communication in the networking era

Disparate products connect across a range of industries

By ELISABETH HORWITT

MIS departments all over the U.S. are asking themselves the same question, with increasing vehemence: "How are we going to link all these different systems we've got installed?"

During the stand-alone era of the 1970s, MIS could safely maintain a *laissez-faire* attitude when it came to a department or division head buying whatever system was best suited to a given task. But then the 1980s ushered in the era of interconnectivity, and those years of unbridled expansion came home to roost.

The new emphasis on networking extends across the full spectrum of industry sectors. Fortune 1,000 service companies that increasingly perceive information as a competitive weapon are installing enterprise networks that enable users throughout the organization to exchange information and share computer data and resources.

In the manufacturing sector, Fortune 1,000 firms are connecting computer devices in different work areas in order to achieve better quality control, lower inventory and faster production cycles. And in research and development firms, users increasingly need to access data and peripheral resources on more than one system.

'One of everything interesting'

"In the research world, it has been very natural for users to try one of everything interesting, and *then* say, 'We want our systems to share data,' " says Daniel Lynch, president of the consulting firm Advanced Computing Environments in Cupertino, Calif.

In all sectors, the need to foster better communications among different departments, divisions and task groups has collided head-on with users' determination to use whatever vendor's personal computer, mini or mainframe best performs any given application. For example, Chase Manhattan Bank Corp., after extensively evaluating departmental office automation hardware, software and communications products, decided to let each user group choose among Digital Equipment Corp., IBM and Wang Laboratories, Inc. products.

While this has made the users happy, it has put a major burden on systems people, who have to connect the disparate products into a corporatewide electronic mail network, notes Craig Goldman, vice-president of consulting and end-user support services at Chase Manhattan.

"We want a peer-to-peer, user-transparent backbone for transmitting documents and messages," Goldman says. "And I don't think it will work if we add a burden of special command keys. The user couldn't care less where a document is — he just wants to get it."

> ***'We want a peer-to-peer, user-transparent backbone for transmitting documents and messages. And I don't think it will work if we add a burden of special command keys. The user couldn't care less where a document is — he just wants to get it.'***
>
> **—Craig Goldman**
> **Chase Manhattan Bank Corp.**

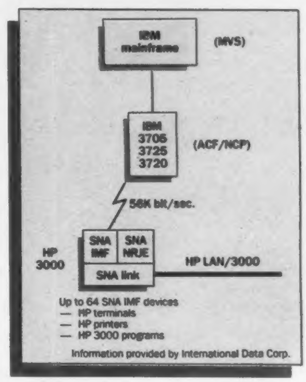
During the past half decade, computer, software and local-area network (LAN) vendors have responded to the interconnectivity needs of companies like Chase with a spate of proprietary network offerings and the much slower appearance of standards that connect different vendors' systems. These can be divided roughly into three categories:

- IBM Personal Computer LANs.
- Third-party LANs that enable different vendors' systems to exchange files and communicate in terminal-to-host mode.
- Proprietary minicomputer-based office automation communications systems.

Since each of these categories serves different user needs, true interconnectivity can only occur when there is an umbrella standard that links all of the major types of communications offerings. That is beginning to happen but is still some years off, analysts say. There is a definite danger, they add, that the gradual convergence of the networking industry could wind up at a single point — IBM's Systems Network Architecture (SNA).

JEFF BABINEAU

SNA: HEWLETT PACKARD CO.



Information provided by International Data Corp.

It has been more than 20 years since the International Standards Organization first began developing Open Systems Interconnect (OSI) as a model for universal connectivity among incompatible systems.

But while most major systems and network vendors have announced their commitment to OSI standards, only low-level protocols are defined enough to be implemented in commercial products. When vendors claim that their products implement all seven OSI layers, they generally mean they have incorporated existing protocols and intend to add the others as they become available.

Companies that do not want to wait five or more years for a fully functional, multivendor communications standard are turning to the proprietary network systems offered by IBM, DEC, Data General Corp. and the rest. Five or 10 years ago, most of the big system vendors offered primitive store-and-forward connections between minicomputers.

IBM, on the other hand, was still working the bugs out of SNA. Apart from the fact that it was difficult to use and almost impossible to understand, SNA had two big drawbacks:

Continued on page 159

The coming of age of the local-area network

The first IBM Personal Computer local-area networks (LAN), following close on the heels of IBM's debut of the PC in 1981, were unimpressive collections of cabling and interface boards that enabled a group of IBM PCs to share peripherals such as hard disks and printers.

While a few adventurous companies installed the early offerings of vendors such as Corvus Systems, Inc., 3Com Corp. and Nestar Systems, Inc., the vast majority felt that any potential savings from peripheral sharing were offset by the expense and hassle of installing and maintaining these systems. A 1984 report by Framingham, Mass.-based research firm International Data Corp. found that 15,800 PC LANs were shipped in 1983. Considering that 1983 IBM PC shipments totaled $1.5 billion, according to Future Computing, Inc., a very small percentage of PCs were being networked a few years ago.

Three developments that occurred in 1984 and 1985 made PC LANs a far more viable alternative to business users:

• The emergence of two standard network operating systems: MS-DOS 3.1, introduced by Microsoft Corp. in the fall of 1984, and Netware, which Novell, Inc. released in November 1983. IBM PC software vendors could then develop versions of their packages that, by interfacing with MS-DOS 3.1 or Netware, could operate over all the network products that support either of those operating systems.

• The appearance of powerful file servers that let PCs concurrently access and update the same files — in contrast to early servers that just let users store their data on dedicated, floppy-size partitions of the same hard disk. The servers turned PC LANs into viable departmental systems, permitting users to share data and peripherals and exchange electronic mail.

• The emergence of gateways and bridges. Gateways gave users access first to IBM Systems Network Architecture and recently to IBM System/36 and 38 processors. Bridges link local networks into a corporatewide system.

"Companies can increase user productivity by making mainframe information available on PCs," says Merv Adrian of the New York PC Users Group. "It's much cheaper to do it via a LAN, because you only need to equip one PC, the gateway server, with a terminal emulation board."

— ELISABETH HORWITT

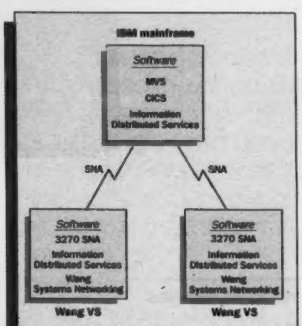
Continued from page 157

It required that everything go through a mainframe host, and it did not connect many of IBM's computer lines — in particular, the IBM PC.

The big system vendors' networking strategies have made great strides in the past few years. The mini vendors, DEC in particular, have come up with sophisticated, user-friendly office automation com-

SNA: WANG LABORATORIES, INC.

JEFF BABINEAU



Information provided by International Data Corp.

munications solutions linking a wide spectrum of products via LANs. Internetwork routing, network management, a consistent, user-friendly interface and peer-to-peer communications are among the network functions that users have demanded and received from most big system vendors in the past few years. The departmental processor/minicomputer office automation host has gained popularity as a file and peripheral server for local work groups and a liaison with corporate mainframes and other parts of the company.

IBM remains the laggard in this area. It still has a way to go before it draws level with DEC in terms of effectively connecting its various incompatible product lines, providing high-level applications for its recently introduced distributed SNA architecture and producing a truly integrated OA strategy.

On the other hand, with IBM firmly entrenched behind its huge installed mainframe base, most of its competitors have reluctantly concluded that they will have to

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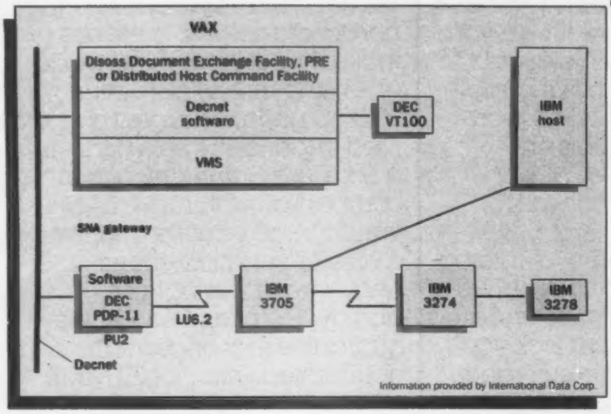
SNA: DIGITAL EQUIPMENT CORP.

JEFF BABINEAU



Information provided by International Data Corp.

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'The bottom line is that, even if you wind up installing a lot of different communications architectures, at least if they are well defined, you'll find some way to bridge them, whether you use SNA, OSI or a third-party vendor's product.'

— Merv Adrian
New York PC Users Group

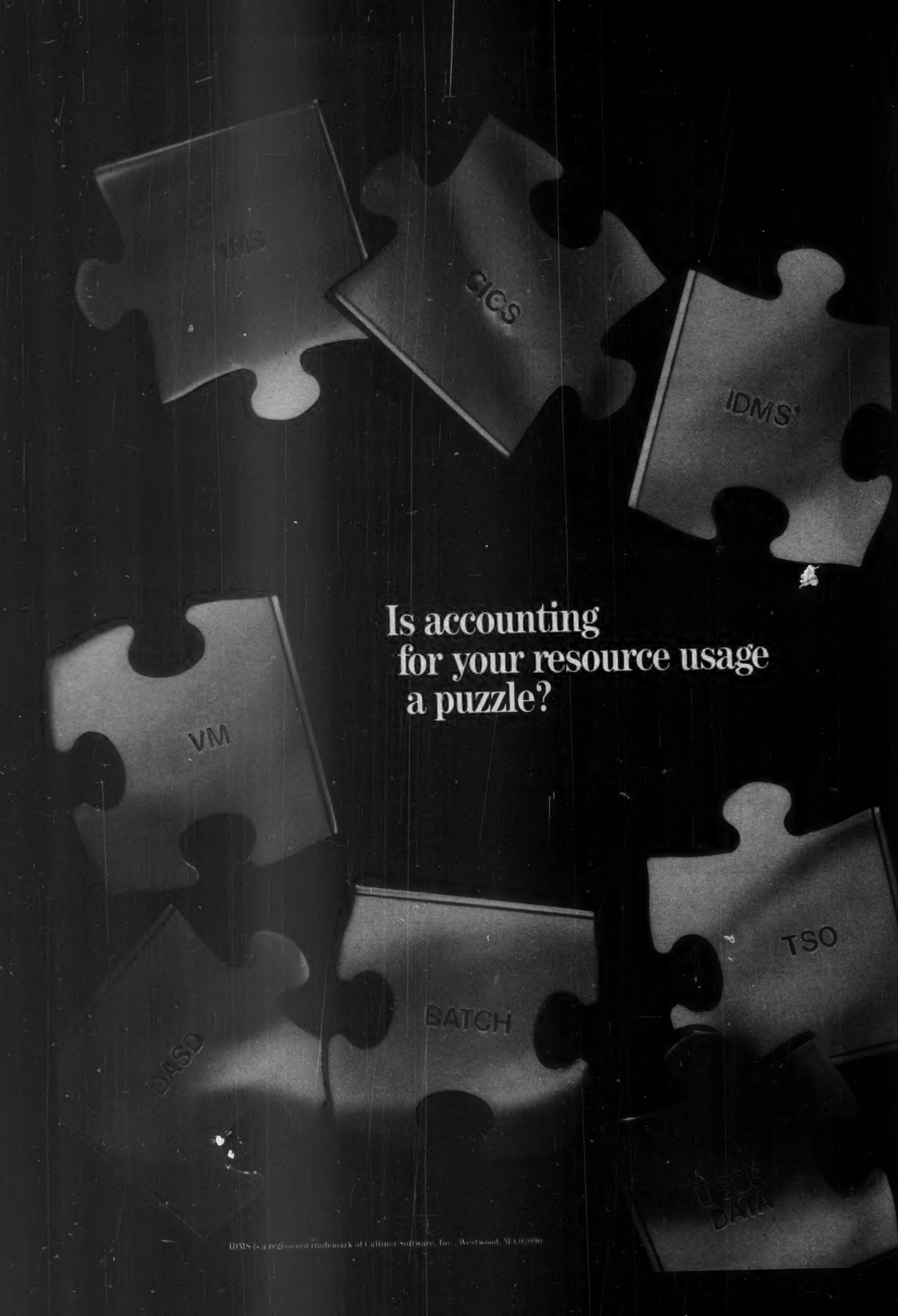
make IBM connectivity part of their communications strategies. In fact, SNA and its offshoots, LU6.2 and PU2.1, may edge out OSI as the standard of choice, according to George Colony, president of Cambridge, Mass.-based Forrester Research, Inc. Now that IBM has joined Corporation for Open Systems, a vendor and user organization dedicated to promoting the development and implementation of OSI protocols, "it is likely that SNA will dominate OSI all the way up to Level 6," Colony says.

The best strategy for IBM's competitors, he goes on, is "not to fight SNA but to use it as a pipe," since IBM's protocols provide application-to-application connectivity and other important functions that are still missing from OSI. Applications can then be run on top of the SNA pipeline.

The immediate benefits of widespread industry support of SNA is that users can have the functionality of a DEC or Wang office automation departmental system networked to their installed base of IBM mainframes. Many customers have responded enthusiastically to the idea. By providing gateways into IBM's SNA, minicomputer vendors such as DEC and Wang are invading Fortune 1,000 corporations that were formerly IBM's exclusive turf, according to Colony. "DEC has moved into IBM accounts like Travelers Insurance Co. and is currently challenging Wang at Hartford Fire Insurance Co. because it has better IBM connectivity products." Chase is among the companies that are considering using SNA as a pipeline between its disparate OA systems.

Communications managers thus do have some choice in how they formulate their strategy for the next few years. They can solve their connectivity problems piecemeal by adding third-party vendor products as they add new computer systems; they can wait for OSI, perhaps using Transmission Control Protocol/Internet Protocol in the meantime, or they can adopt a multivendor strategy with SNA as the glue. Or they can remain faithful to one vendor's solution. That option is becoming less viable to many companies that are making communications a key element of their competitive strategies.

Merv Adrian of the New York PC Users Groupp provides a ray of hope. "The bottom line is that, even if you wind up installing a lot of different communications architectures, at least if they are well defined, you'll find some way to bridge them, whether you use SNA, OSI or a third-party vendor's product. The one thing I've learned is you can't tell users what to use — you can only help them communicate." ■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Reaching higher levels of connectivity with TCP/IP

In the early 1980s, network vendors such as Ungermann-Bass, Inc., Bridge Communications, Inc. and Excelan, Inc. began introducing network interfaces and servers designed to meet the needs of manufacturers, research and development firms and other companies whose users often needed to access multiple hosts from different vendors.

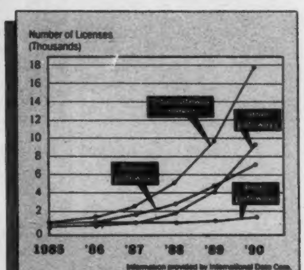
These products typically interfaced a variety of systems to a broadband or baseband coaxial cable and supported some version of Ethernet, along with the then-dominant communications protocols: Digital Equipment Corp.'s Decnet, Xerox Corp.'s Network System and the Transmission Control Protocol/Internet Protocol (TCP/IP).

TCP/IP has emerged as the closest thing to an industry standard, largely because the U.S. Department of Defense, which commissioned the protocols' development in the first place, requires that TCP/IP be used by all of its contractors. TCP/IP has gained a following among research and development firms — and thus among the primarily Unix-oriented vendors that sell computers to R&D firms.

"The big spread of TCP/IP began when Berkeley 4.2 Unix was released, and everybody and his brother began putting it into their boxes,"

JEFF BABINEAU

OFFICE GATEWAYS: MARKET FORECAST BY LICENSE



says Daniel Lynch, president of the consulting firm Advanced Computing Environments in Cupertino, Calif. Like TCP/IP, Unix 4.2 was backed by the Defense Department. "So people said, 'Hey, we'll take what's available in terms of connectivity,'" Lynch says.

Around 1984, TCP/IP was adopted by vendors such as Ungermann-Bass and Bridge, which sell networks to both the commercial and government/research sectors. TCP/IP's major drawback is that it provides only the basic network functions such as routing, error checking, file transfer and terminal emulation.

Important high-level functions such as network management, application-to-application communications and exchange of editable documents across a multivendor network are lacking. Users have discovered that one vendor's implementation of TCP/IP does not necessarily communicate with another vendor's.

Virginia Metze, a systems manager for the University of Illinois Materials Research Laboratory, sees TCP/IP as a far from perfect communications solution. "People keep saying TCP/IP is a standard, without mentioning the fact that it is primarily Unix-based," she says. The university is currently converting to a TCP/IP-based network, Metze reports, but her group successfully lobbied MIS for permission to go on using DEC's communications protocol, Decnet, to communicate among themselves and with the rest of the organization.

Her objections to TCP/IP are manifold. Unlike Decnet, it does not provide record-level access, she says, and connecting DEC systems to a TCP/IP network would have required third-party software, since the VMS operating system does not support TCP/IP directly, she adds. Metze expects that the university will eventually adopt the Open Systems Interconnect (OSI). Adopting TCP/IP "would make us keep to the connectivity schedule of small computer vendors that implemented Unix and a C compiler rather than large companies like IBM or DEC," Metze notes.

At the recent TCP/IP Vendors' Workshop in Monterey, Calif., a vendor coalition was formed to try to iron out incompatibilities, develop applications and, in general, discuss how TCP/IP can become a more suitable interim communications standard while the world waits for OSI standards to emerge.

— ELISABETH HORWITT

> *'The big spread of TCP/IP began when Berkeley 4.2 Unix was released, and everybody and his brother began putting it into their boxes.'*
>
> — Daniel Lynch
> Advanced Computing Environments

Father of PC dons new hat studying medicine

By DAVID BRIGHT

MICRO PIONEERS

After keeping a low profile for nine years, Ed Roberts — the father of the personal computer — is back.

Roberts, who designed the popular Micro Instrumentation and Telemetry Systems (MITS) Altair, now keeps busy juggling two careers: medicine and computers.

Currently a resident in internal medicine at the Medical Center of Central Georgia in Macon, Roberts also recently founded Datablocks, Inc., which makes real-time personal process control systems.

Aiding the handicapped

While remaining involved with Datablocks, Dr. Roberts hopes to open a private practice in a rural area. In addition, he is investigating ways of drawing upon his medical and technological backgrounds to help the handicapped.

Following graduation from a Miami high school in 1959, Roberts spent 10 years in the U.S. Air Force, earning his degree in electrical engineering along the way. While stationed at Kirtland Air Force Base in Albuquerque, N.M., Roberts and three of his friends began making transistorized radio transmitters and lights in their spare time, which they sold by mail order to model airplane enthusiasts.

They incorporated MITS in 1969 and in 1971 made a name for themselves by producing in kit form one of the first large-scale-integration-based programmable calculators.

Competition trouble

But after encountering tough competition from larger companies, MITS found itself $350,000 in the hole in 1974 and moved on to its next challenge — making minicomputer power available to the average person in an affordable system. Roberts designed the machine around Intel Corp.'s 8080 microprocessor, with memory expandable from 256 bytes to 64K bytes.

"We were down the tubes at that point," Roberts recalls. "We went to our banker and said, 'Look, we've got this product that's going to come out, and we think it's going to do really great. You need to give us another $65,000.' "

MITS managed to obtain the money from the bank. Heralded as a breakthrough, the Altair 8800 appeared on the cover of the January 1975 issue of *Popular Electronics* magazine. The first machines sold for a price of $297 without a case, $395 with a case, and the response was totally unexpected.

High MITS demand

At that time, Steve Wozniak had yet to build the first Apple I, and the announcement of the IBM Personal Computer was more than six years away. However, MITS was immediately deluged with 4,000 orders. With the help of Bill Gates and Paul Allen, who wrote a Basic interpreter for the Altair, MITS sold some 30,000 systems throughout the next 2½ years. With the Altair, Roberts claims to have been the one to coin the term "personal computer."

What is now Pertec Computer Corp. bought MITS in 1977 for $6 million, and a year later it ceased production of the Altair as the market became more competitive. The Altair's bus lives on, however, as the S-100 bus, around which a multitude of systems have been built.

Based in Glenwood, Ga., Roberts' new company introduced its first product, the Altair-II Personal Control System, last July. With a set of over 30 stackable hardware building blocks, users can construct systems according to their particular application needs.

Wide application range

The range of potential applications includes security systems, environmental control, robotics and production line automation.

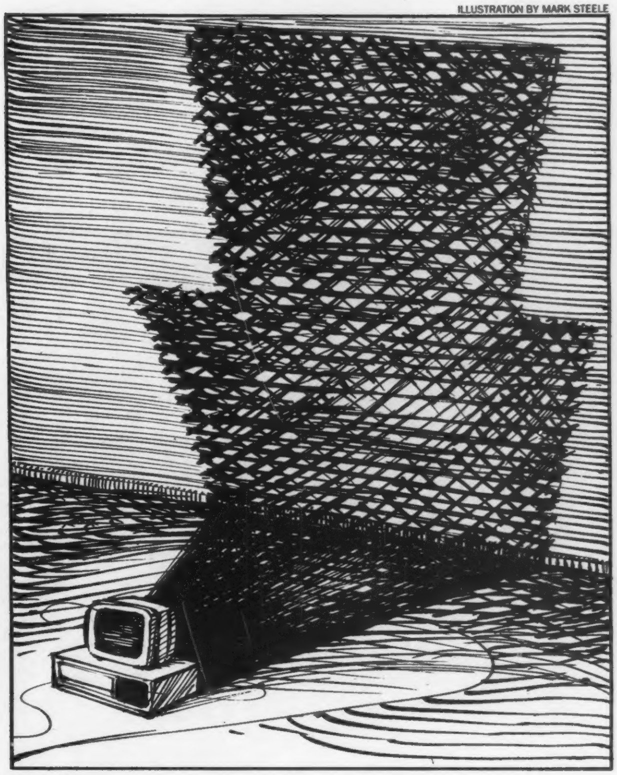
Roberts is also investigating the feasibility of building a sophisticated, voice-actuated wheelchair for paralyzed persons. Another possible project is finding a way to help muscular dystrophy victims take advantage of their intact central nervous systems.

"I enjoy what I'm doing," Roberts says.

Ed Roberts, Datablocks, Inc. founder

Micros in MIS: A tiger by the tail

ILLUSTRATION BY MARK STEELE



By DOUGLAS BARNEY

It was more than a decade ago that the once-lowly microcomputer was born. On that first arrival, many called them toys. They were not only difficult to use, but also lacked power. Random-access memory was measured in bits, not bytes, and packaged applications software was nonexistent, leaving most MIS executives unimpressed.

But despite its relatively quiet birth, the micro has shaken the very foundation of data processing and captured the imagination of an American public that had never felt comfortable with computer technology.

"People are going PC crazy," notes Recy Dunn, director of adminstration services/MIS at Big Three Industries, Inc., a Fortune 500 firm based in Houston.

No end to capability

Already microcomputers can access data bases of more than a gigabyte on optical disks, act as multiuser platforms, connect with a variety of host and departmental processors and, in some cases, even replace expensive mainframe installations. And there appears to be no end in sight.

Microcomputers are not only getting better, they are getting much cheaper. Lower component costs and the the rise of an IBM standard for PCs have allowed a myriad of manufacturers to survive and drive prices down. An IBM-compatible can now be had for as little as $365 through mail order. "It is almost mind boggling how this is happening and how these people are staying in business," says Fred M. Zickert, manager of personal computers for Eaton Corp. in Cleveland.

Microcomputers have shaken the very foundation of data processing

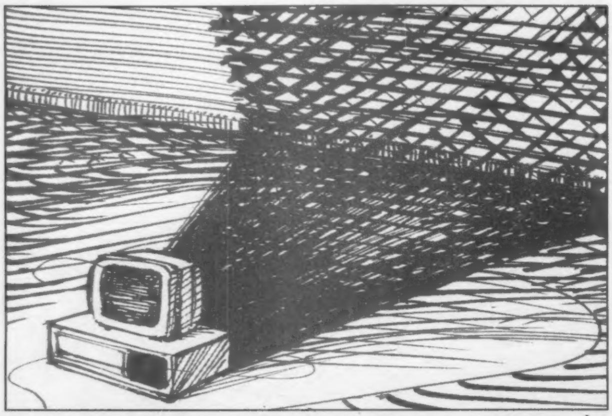
The low price of microcomputers has led to a proliferation of applications. For example, an IBM Series/1 PC allows Sam K. Leming to run minicomputer software on a lower cost machine and thus distribute processing to more users. Leming is DP manager for Kroger Co., a nationwide chain of pharmacies and supermarkets. "We can put a PC in there, and the support is the same as that for the Series/1," he says.

Low cost is just one advantage of microcomputer technology. While a mainframe might take up an entire air-conditioned room, micros generally require a portion of a desktop. And while mainframes may require a staff of experts to keep them up and running, micros can be piloted by a novice.

Micros can also act as a variety of terminal devices and even processors through various software and hardware products. "Emulation boards make the PC the ideal workstation for everything," Leming says.

"The communications facilities are what really moved the PC into data processing. The terminals have gone away; the PCs have replaced them. We have a dual-function machine, and it is doing the job very well," Eaton's Zickert says.

Despite their constant increase in capability, micros keep getting smaller. Transportable computers, many with hard disks and built-in printers, allow users to compute on the road and use the same machine for home and office use. Laptop computers go a step farther and allow computing on airplanes, in the woods or on the desk. Hand-held computers



'We used to have a running joke, "I want a Cray micro." By God, you will have one one of these days, probably in your vest pocket, and it will have unlimited memory.'

— Samuel P. Lyles
Business Records Corp.

help keep track of warehouse inventories and can upload their data to larger systems.

Indeed some true computer buffs wear watches that store data or program codes that can be sent to other systems. Bicyclists enjoy a range of computers that can keep track of heart rate, speed, distance and time.

The stage is set for another microcomputer revolution. The performance of microprocessors is now measured in million instuctions per second (MIPS) and potential addressability in gigabytes. The main thrust of this power will be to provide a quantum leap in the capability of single-user workstations.

Micros based on the Intel Corp. 80386, running at 4 MIPS with a potential address space of 4G bytes, have already hit the market, and machines based upon the Motorola, Inc. 68020 and 68030, the latter of which runs at 8 MIPS, are either introduced or on the way.

Still, most of the power of these processors, particularly the Intel 80386, is potential. As usual, systems software and applications software are lagging behind hardware advances. In fact, the major advantage of machines based on these new processors is increased speed rather than the ability to run larger and more sophisticated software.

Despite what some might call technological overkill, hardware developers still are not satisfied. "We used to have a running joke, 'I want a Cray micro.' By God, you will have one one of these days, probably in your vest pocket, and it will have unlimited memory," remarks Samuel P. Lyles, a theoretical physicist and director of research and development for Business Records Corp., a computer firm based in Dallas.

Optical computers

Optical computers operating at the speed of light offer another possibility, but the development of and applications for optical computers may be long in coming. "The optical computer is truly blue sky," notes Charles Simoni, head of applications development for Microsoft Corp.

And, according to Lyles, progress in storage media, much of it occurring at Carnegie-Mellon University, has just as far-reaching implications. "They have already built a prototype of a storage medium with one gigabyte per square centimeter, and the theoretical limitation of what they are doing is 100 trillion bytes per square inch," he says.

"Where we are lacking and the next big frontier now is what to do with all this horsepower for society in general. We need a greater emphasis on application engineering. The guys inventing hardware are eons ahead of everybody else."

But problems are certain to emerge with the quickening pace of hardware technology. "If I have 100 terabytes of storage and I put that much data out there, how do I find it when I want it? Trying to find a record in a 100-terabyte disk is like identifying a grain of sand somewhere between Earth and the moon," Lyles says.

Microsoft's Simoni has already

gone through such a revolution and eagerly anticipates another. In 1965 while living in Hungary, Simoni worked with Soviet vacuum tube computers.

By 1972, however, he was working at Xerox Corp.'s Palo Alto Research Center, a center that has since defined much of the current state of micro technology. "I jumped into a time warp," Simoni says.

Although his expectations may not be as high as Lyles', Simoni sees major change ahead: "1986 is a transitional year," Simoni says.

Performance plateau

Software for the more advanced microprocessors remains the key question. "The 80386 and the 68020 are just around the corner, and when those machines arrive we will see a kind of plateau in the performance area that will allow software to consolidate," Simoni says.

Simoni downplays some of the expectations for the next generation of hardware. "Four gigabytes [of addressable memory of the 80386] is somewhat of a hype. A couple of hundred megabytes will push the limits of the 80386."

Again, software is to blame. "If we do use that much memory, software development cycles will get longer," Simoni says.

In addition, larger programs will consume CPU cycles and decrease CPU speed. Some mainframe applications, however, will find their way to micros, according to Simoni. In those instances, writing for a microcomputer becomes just as complex as writing for a mainframe.

But some of the most stunning advances may not be purely based upon faster chips, greater storage or a larger address space. Networking microcomputers promises to bring change to the structure of data processing systems.

Networked PCs, tied to micro-based file servers or minicomputers, will replace or augment host-based systems, particularly on a departmental level, according to some.

Problem with networking

The problem with networking is the lack of a truly sophisticated network operating systems and a shortage of high-quality applications.

"Once we get to some reasonable local-area network and departmental processor, we will see a lot more functions downloaded to them," says Don Norman, vice-president of MIS for Montgomery Ward & Co.

With better networking software as well as more sophisticated file servers and departmental processors, networking may finally come of age.

The future of departmental computing may well be on LANs rather than on minicomputers," says Merv Adrian, senior programmer analyst for Shearson, Lehman Brothers, Inc. and chairman of the New York PC micro-to-mainframe Special Interest Group of the New York PC Users Group.

Adrian looks to Intel 80386-based file servers or departmental controller devices as a way of replacing minicomputers such as the IBM System/36 and 38.

Regardless of which path microcomputer technology takes, it is clear that the micro has become, and will remain, an indispensable part of computing for years to come. ■

'Four gigabytes [of addressable memory of the 80386] is somewhat of a hype. A couple of hundred megabytes will push the limits of the 80386.'

— Charles Simoni
Microsoft Corp.

John Blankenbaker: Inventor of Kenbak-1

Also designed first Symbolics AI unit

By DAVID BRIGHT


John Blankenbaker

After 15 years of dreaming about a low-cost computer that the general public could afford, John Blankenbaker in 1971 finally produced such a system. Taking six letters out of his name, he dubbed the $750 system the Kenbak-1, playing on the name's similarity to that of the popular, low-cost Kodak camera. Unfortunately, only 48 of the bread box-size 256K-byte systems were sold, forcing Kenbak Corp. to go out of business in 1973.

Perhaps atoning for that disappointment, however, the Kenbak-1 took top honors in The Computer Museum's Early Model Personal Computer Contest held this May in Boston. And after building the Kenbak-1, Blankenbaker went on to design Symbolics, Inc.'s first artificial intelligence workstation.

> *'It caught the public's fancy that a computer could be put on a chip and not have to be expensive.'*
> — John Blankenbaker

Primarily intended for educational purposes, the Kenbak-1 used eight data buttons for input and eight lights for output. It ran assembly language, which had to be compiled by hand. Concerning sales to the public, Blankenbaker says the machine's small size and low price actually worked against it.

"I had found that individuals were very dubious," he recalls. "Most individuals regarded computers as giant, expensive machines. They couldn't believe that a relatively small machine at a reasonable price could exist that would allow some reasonable problems to be run."

Since the Kenbak-1's processor was built from several components, it was not a microprocessor. Although having a microprocessor was not a strict requirement for PCs, Blankenbaker says that personal computers later became extremely popular partly because of the public's fascination with microprocessors. "It caught the public's fancy that a computer could be put on a chip and not have to be expensive," he says.

But by then, Kenbak had closed its doors.

Blankenbaker conceived the idea of a small, affordable computer while working on a binary-coded arithmetic project as an engineer at Hughes Aircraft Co.

Following his stint at Hughes Aircraft, he did some consulting work and then joined what is now Quotron Systems, Inc., where he spent eight years.

Blankenbaker then struck out on his own and formed Kenbak. After Kenbak folded, he built a computer system for International Communication Sciences that allowed the digital transmission of voice. At Symbolics, he designed a production version of the LM-1 artificial intelligence system that had been developed at MIT.

Blankenbaker returned to Quotron in 1983 and retired two years later. Now he plays the stock market from his home in Chadds Ford, Pa., and says he has barely touched a computer in the past year. ■

Managers wait at crossroads of 80386-based technology

By DAVID BRIGHT

Because the future direction of Intel Corp. 80386-based systems remains unclear, managers are having a difficult time planning their personal computer strategies. Although the 32-bit 80386 microprocessor holds great promise as the basis of advanced personal computer and multiuser systems, it will take time for such systems to be developed, along with appropriate software, and for a standard to emerge.

In the near future, there are three directions that the 80386 personal computer market could take. It could follow either Compaq Computer Corp., the first major vendor to introduce an 80386-based system; or the Personal Computer Extended Technology Standards Committee (PCET), which is trying to set an IBM Personal Computer AT-compatible bus standard with a 32-bit extension; or IBM, provided Big Blue introduces an 80386-based PC as expected. Compounding the problem, it is uncertain what version of Microsoft Corp.'s MS-DOS will be the dominant operating system on the new machines.

> **'This is the most difficult time we've had in years.' Questions about the market have no clear-cut answers.**
>
> — Julian Horwich, CAMP director

For planning, "this is the most difficult time we've had in years and years," says Julian Horwich, director of the Chicago Association for Microcomputer Professionals (CAMP) and technology planner at a large pharmaceutical company. Horwich says CAMP's members have many questions about the 80386 market but no clear-cut answers.

With no clear indication of what 80386-based systems will be on the market in one or two years, members are unsure whether they should plan to stick with 80286-based technology. In addition, members need to know for which operating system the key software developers plan to write their applications, whether it be MS-DOS in 80286 protected mode, a proprietary IBM version of PC-DOS or some other version. Much depends on IBM's plans, Horwich says.

Dataquest, Inc. analyst Norm DeWitt, who expects IBM to introduce its 80386-based machine in the second quarter of 1987, says a replay of the IBM AT's acceptance is likely to occur with the new machine. The AT was introduced in August 1984, and through the end of 1984, 71,000 systems were sold, according to Dataquest estimates. In 1985, AT sales bulged to approximately 475,000 systems, DeWitt says. However, he does not rule out the possibility of the Compaq system being better received than the IBM system.

The PCET industry committee boasts some 65 members, including representatives from ROM BIOS supplier Phoenix Technologies, Ltd., Emulex Corp. and Olivetti Advanced Technology Center, Inc. Its proposal for a 32-bit bus extension could catch on, but many observers are quick to point out that the marketplace, not committees, sets standards.

"We're going to sit on the sidelines on that issue and wait to see in what direction the market goes," states Ed

Continued on page 176

MICROPROCESSORS: INTEL CORP.'S 80 SERIES

	8088/86	80286	80386
Internal Architecture	8/16 bits	16 bits	32 bits
Address Size (in bytes)			
Physical	1M	16M	4G
Logical	1M	1G	64T
Number of Transistors	5,500	134,000	275,000
Relative Performance	1 (at 4.77 MHz)	4 (at 8 MHz)	8 (at 16 MHz)
Modes Supported	Real	Real, Protected	Real, Protected, Virtual 86, Native
Multitasking Support?	No	Yes	Yes

Information provided by Intel

Unix operating system taps Intel effectively

An operating system is available that makes better use of the Intel Corp. 80286 and the 80386 than Microsoft Corp.'s MS-DOS. It is Unix.

Compaq Computer Corp.'s Deskpro 386 runs Microsoft's Xenix V/286 version of Unix, and Microsoft says it will deliver a version tailored for the 80386 in the first quarter of 1987. While Xenix gives 80286- and 80386-based systems multiuser capability and expands their attractiveness as technical workstations, MS-DOS — with its tremendous base of applications software — is for the near term expected to remain the personal computer operating system standard. But MS-DOS will eventually run as a task under Unix on most new systems, predicts Intel 80386 Marketing Manager Dana Krelle.

Compared with personal computer systems, 80386-based multiuser systems running Unix are less bound by IBM's 80386 strategy and Microsoft's MS-DOS plans. Observers say such multiuser machines, which should begin to arrive in the first half of 1987 and carry prices in the $9,000 to $30,000 range, could dramatically impact the market for departmental systems. The first such machine may come from Altos Computer Systems, Inc., which is developing a 60-user system that will range in price up to more than $40,000. Other likely candidates include Convergent Technologies, Inc., Sperry Corp. and even Wang Laboratories, Inc. and Data General Corp.

William Welty, an analyst with Hambrecht & Quist in San Francisco, refers to the coming batch of 80386-based multiuser systems as "VAX killers," because their expected per-million instructions per second (MIPS) cost is $5,000, compared with the $60,000 per-MIPS cost on superminicomputers like the VAX. The systems will also have the ability to run the huge base of MS-DOS applications.

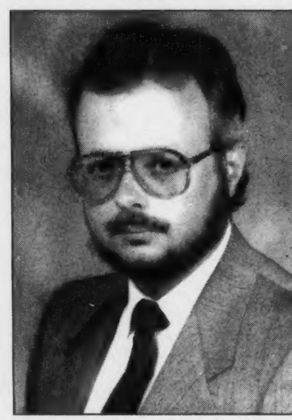
This MS-DOS capability also gives the 80386 an advantage over Motorola, Inc.'s competing 32-bit MC68020 microprocessor, which in 1985 accounted for 60% of the 32-bit microprocessor market, Dataquest, Inc. estimates indicate. But in September, Motorola put more pressure on Intel by announcing the 8-MIPS 68030 microprocessor, which, like the 80386, has an on-chip memory management unit. Welty expects Intel to respond to Motorola's challenge by upping the 80386's speed from 16 MHz to 20 MHz in early 1987.

— DAVID BRIGHT

Continued from page 175

Juge, director of marketing planning at Tandy Corp. "When IBM enters the market, we'll know what the standard is." Tandy's official opinion is that the 80286 will be the primary personal computer chip through the rest of this decade, Juge notes.

A common complaint among managers is that the 80386 situation represents a classic case of hardware outpacing software. Although the 80286 can address 16M bytes of physical memory, and the 80386 can address 4G bytes, the current version



Lummis Crest's John Sykes

of MS-DOS addresses only 640K bytes. Further, both the 80286 and 80386 support multitasking, while MS-DOS does not.

"It makes you wonder, Is Intel going to come out with an 80586 that has no software for it?" asks Earl Phillips, who plots personal computer strategy at Arvin North American Automotive in Columbus, Ind.

Like many managers, Phillips is keeping an eye on Compaq's Deskpro 386, but he is not planning to rush out and buy any. The Compaq system basically offers double the speed of a PC AT, but with the possible exception of computer-aided design applications, having that extra speed is not crucial. If his company did decide to buy any Deskpro 386s, they would probably be used as file servers in a local-area network, Phillips says.

With its extra power, and optional 130M-byte hard disk drive with a fast access time of 19 msec, the Deskpro 386 is being positioned as a file server for other personal computers as well as a stand-alone system.

While many managers are hesitant about buying 80386-based hardware at the present time, they will naturally take a more serious look at the technology when IBM enters the market.

"We're still trying to catch up to the 80286," remarks John Sykes, manager of office automation at Lummis Crest, Inc. As a construction and engineering subsidiary of Combustion Engineering, Inc., Lummis Crest in Bloomfield, N.J., currently augments its IBM PC XTs and ATs with Compaq transportable systems.

No great need for 386 now

"When IBM comes out with one [an 80386-based system], we will have to evaluate our long-range planning to see how the product is going to fit in," Sykes acknowledges. "But right now there's no screaming need for it [the 80386]."

Sykes says the same thinking applies to 80386-based accelerator boards, which are said to double the speed of applications running on existing PCATs. Intel late last month introduced its $1,995 Inboard 386/AT board, which runs at 16 MHz, and similarly priced boards are expected from several other vendors by early 1987. Although he plans to stay abreast of the current technology, Sykes will "not start upgrading people if they don't need it."

"A chip in itself is not of any value," adds David Epstein, manager of electronic text processing at Dow Jones & Co. textbook publishing subsidiary Richard D. Irwin, Inc. in Homewood, Ill. "I'm not that excited by raw processor speed."

Epstein says his company could benefit if minicomputer publishing packages were ported to 80386-based systems but adds that he is not as eager to buy a new system now as he was five years ago since his company already has a lot invested in the technology.

Given the higher prices of 80386-based equipment and the lack of complementary software, some managers say that if they need to run more powerful applications, they can often tap a hidden resource: the same minicomputers that the 80386 is predicted to rival.

"I don't want to break the bank," states Russ Heilman, who runs an information center for Wisconsin's Department of Industry, Labor and Human Relations in Madison.

Before putting out additional money for 80386-based systems, Heilman says he will first look to his department's VAX superminicomputer for the needed power.

Operating system software needed

In addition to a hardware standard, what's sorely needed in order to give 80386-based PCs a boost is advanced operating system software.

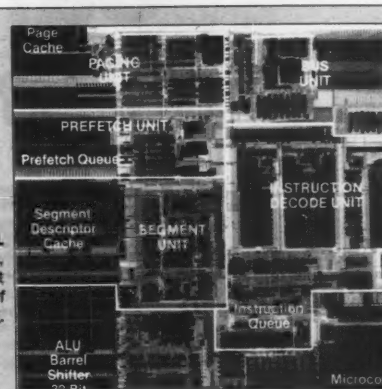
Although 80386-based hardware can essentially put the power of a superminicomputer on a desktop, the MS-DOS operating systems currently available for PCs simply cannot harness that power. For that matter, even the 80286 is not used to its fullest potential.

Like the 80286, the 80386 supports multitasking. But in addition, the 80386 has the ability to run several operating systems at once — whether they be MS-DOS, Unix or even proprietary. While maintaining compatibility with the 8086, 8088 and 80286, the 4MIPS 80386 can address 4G bytes of main memory and 64 trillion bytes of virtual memory.

Although the 80286 can address 16M bytes of main memory, the present versions of MS-DOS put a 640K-byte limit on the amount of memory that can be addressed. Microsoft is working on the next version of MS-DOS, which will support multitasking and eliminate the 640K-byte barrier.

Selected applications developers are currently testing the new MS-DOS, which should finally be released in 1987. The new MS-DOS is being designed to run on 80286 and 80386 systems, as the 8086 and 8088 do not support multitasking.

One can only guess as to when a DOS that takes advantage of the 80386's extended capabilies will be available. ■



PARTIAL DETAIL of an Intel 80386 chip, which some expect may change the face of computing.

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C Developers

Senior Systems Developer (C Compiler) will work on code generation and optimization for the SAS/C™ compiler and library for IBM® mainframes. A bachelor's degree in computer science, mathematics, or a physical science is required. In-depth knowledge of the C language, IBM 370 object code, and compiler optimization techniques (both machine-independent and machine-specific) is required. Experience with compiler front-ends or mathematical programming in IBM 370 assembler language is a plus.

Assistant Software Developer will design and implement SAS System features in the C language for data processing and information management. This includes features to generate reports, query data bases, and produce plots and charts. Other responsibilities include supporting existing procedures in the C language. Applicants must have a bachelor's degree in computer science or the equivalent in education and work experience. Knowledge of data structures, programming language design and implementation, parsing, grammar construction, and the C language is required.

MVS

Systems Developer will develop and maintain the SAS System supervisor components for the IBM MVS environment that interfaces to communication terminals such as IBM 3278, 3279, 3287, and 3268. Applicants must have knowledge of one or more of the following: SNA protocols, the ACF/VTAM access method, 3270 data streams, MVS/XA supervisor services, or IBM 370 assembler language. Experience with developing and supporting large software systems, VTAM/NCP service aids, the C language, and the SAS System are significant assets. A bachelor's degree in computer science or equivalent work experience is required.

Systems Developer will analyze the performance of the SAS System under MVS. Specific responsibilities include identifying any performance problem areas, suggesting ways to improve system performance, and helping implement the changes. Candidates must be able to develop a comprehensive performance management program including creating test suites for performance comparisons between releases. Knowledge of data and storage management techniques and algorithms is required. Applicants should have a minimum of three years' systems programming experience. Technical proficiency in IBM 370 assembler and one other high-level language (C preferred); and a bachelor's degree (computer science preferred), or equivalent experience, are required.

CMS

Systems Developer will work in the area of performance analysis for the SAS System under CMS. Responsibilities include implementing a methodology to perform the analysis, and designing prototypes to ensure the quality and efficiency of the SAS System under CMS. Applicants must have a bachelor's degree in computer science or equivalent work experience; experience in VM/CMS performance analysis, and/or experience with large applications systems. Proficiency in IBM 370 assembler language is required. Knowledge of C, PL/I, and FORTRAN is helpful, and knowledge of SAS software is a plus. A minimum of three years' programming experience is preferred.

Systems Developer will design and implement the SAS System full-screen interface under CMS, and will participate in implementing the SAS I/O subsystem under CMS. Applicants must have a bachelor's degree in computer science or equivalent work experience, and a working knowledge of VM/CMS and IBM 370 assembler language. Knowledge of C, PL/I, and FORTRAN is helpful, and knowledge of SAS software is a plus. A minimum of two years' programming experience is preferred.

DOS/VSE

Systems Developer (IBM 370 Assembler) will be responsible for writing, maintaining, and debugging the SAS System interface code for the DOS/VSE environment, and diagnosing and fixing problems encountered when porting SAS software to the DOS/VSE environment. Applicants must have a bachelor's degree in computer science, mathematics, or a physical science, or equivalent work experience. Excellent knowledge of IBM 370 assembler language, and of system interfaces on at least one IBM mainframe operating system is required. Knowledge of at least one high-level language (C preferred) is also required. DOS/VSE experience and assembler-level debugging experience are desired.

VAX™

Systems Developer will assist in developing the SAS System under VMS.™ Applicants must have experience in I/O interfacing, including graphics and full-screen, disk and tape drives and devices. Requirements include in-depth knowledge of VMS internals, knowledge of RMS/QIO and data base internals, a minimum of three years' experience as a VMS system programmer, and a bachelor's degree in computer science or equivalent work experience.

Prime

Systems Developer will be responsible for porting the SAS System to the Prime 50 series machine and for developing machine (host) interfaces, which include memory management interfaces, I/O interfaces (disk, tape, terminal, and other devices), and interfaces to other low level operating system functions. This person must have a bachelor's degree in computer science or equivalent work experience, and in-depth knowledge of PRIMOS® internals. Knowledge of the C language and the SAS System is desired.

Data General

Systems Developer will be responsible for porting the SAS System to the Data General ECLIPSE® MV series under the AOS/VS operating system and for developing machine (host) interfaces, which include memory management interfaces, I/O interfaces (disk, tape, terminal, and other devices), and interfaces to other low level operating system functions. This person must have a bachelor's degree in computer science or equivalent work experience, and in-depth knowledge of AOS/VS internals. Knowledge of the C language and the SAS System is desired.

Applications

Assistant Systems Developer will be responsible for developing and maintaining SAS/FSP® software. Applicants must have a bachelor's degree in computer science or equivalent work experience, a minimum of one year's programming experience, and an in-depth knowledge of the C language. Knowledge of the SAS System is desirable.

Software Developer will be responsible for designing and programming decision support and financial modeling software tools. Responsibilities include researching DSS methods, writing preliminary documentation, and evaluating user feedback. A bachelor's degree in a quantitative field or equivalent work experience is required; an advanced degree is preferred. Applicants must have experience with one or more of the popular financial modeling products and familiarity with modern financial methods. Substantial programming skills are required. Knowledge of the C language and the SAS System is preferred, and knowledge of numerical techniques is a plus.

Relational Data Base Software Developer will research state-of-the-art relational data base management techniques, including distributed data bases, clustering techniques, and language and interface design. Applicants must have a Ph.D. in computer science or equivalent work experience.

Data Management Tester will test and document fourth generation languages, data base management systems, SQL, and reporting features. A bachelor's degree in computer science or equivalent work experience is required. Experience with the SAS System, data base management systems, and query languages is preferred. Applicants must have a strong programming background and be highly motivated.

Senior Mathematician will research and develop numerical software for scientists and numerical analysts. Applicants must have a Ph.D. in mathematics or physics or equivalent work experience. Experience in the areas of numerical solution of differential equations, integration, function approximation, linear algebra, and special functions is required.

Language Processing

Systems Developer will be responsible for the research and development of natural language processing and speech recognition products and their integration into the SAS System. Applicants must have an advanced degree in computer science or computational linguistics, and four years' related work experience. Technical proficiency in LISP and/or the C language is required, and a working knowledge of SAS software is desired. Experience with writing a natural language product and support of large software systems is desired.

Quality Assurance

Quality Assurance Analyst will design, implement, and conduct testing strategies for SAS software, including data base interfaces. Other duties include developing software tools to automate the quality assurance process. Applicants must have a bachelor's degree in computer science or information management, or equivalent work experience. Preferred experience includes two years' designing, implementing, or administering data base management systems and products, such as SYSTEM 2000 DBMS, DB2, SQL, and IMS; two years' experience programming with the SAS System; and two years' experience in one of the following areas: OS/MVS, VM/SP, TSO, CMS, ISPF, or DOS/VSE. Good communications skills are required.

Quality Assurance Associate Analyst will assist in testing SAS software for personal computers. Duties include writing test programs and tools, and processing programs under supported operating systems. Applicants must have a bachelor's degree in a quantitative field, one year's programming experience, and a working knowledge of the SAS System.

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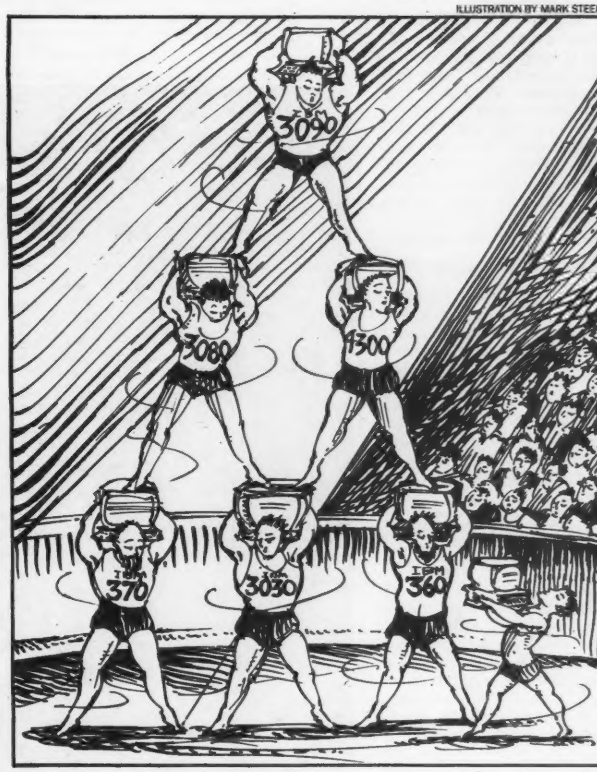
The price of success: IBM 370 system just won't die

ILLUSTRATION BY MARK STEELE



By JAMES CONNOLLY and JEFFRY BEELER

The key term was common architecture, which meant common peripherals, common software and common operations staffs.

More than two decades have passed since the launch of the earliest major effort to produce a single computer architecture for all types of users. The project's name carried a number derived from the concept of serving everybody. To IBM, the 360 stood for all degrees on the compass.

The IBM 360 was the first of a series of processor families, including today's 3090 and 4300 product lines, that are collectively known as the 370 architecture machines. For reasons that current and former IBM officials cannot explain, the architecture carries the 370 number — derived from its announcement during the 1970s — rather than the original 360 label.

Few common elements

There are few common elements from the System 360 models announced in 1964 remaining in the 3090 Model 400s that began shipments last summer. But IBM officials boast that software written for a 360 can still run on a 3090, and for those two decades IBM has served commercial users, engineers and scientists with the same types of systems.

IBM is unlikely to scrap the 370 architecture in the near future

IBM has maintained that commitment to a common architecture, at least at the large-systems level, for more than the 20 years that the company originally hoped for. Surpassing that 20-year mark raises the question of how much longer IBM can stay with that 370 architecture.

In addition, while IBM has solved some compatibility problems at the high end of the computing business, new markets — markets for computers that were almost nonexistent 20 years ago — have raised questions on how IBM can provide compatibility. With the recent introduction of its 9370 low-end 370 systems, IBM has at least seven active product families, with five separate architectures, in the minicomputer and superminicomputer performance range.

To complicate matters still more, each architecture has a different means of dealing with personal computers — another type of computer that did not exist 20 years ago — and word continually leaks out of IBM about engineers working on new architectures, ways to merge architectures and ways to package mainframe technology in still smaller boxes.

The lack of low-end and mid-range compatibility has made IBM a target for vendors such as Digital Equipment Corp., which claims to offer desktop to high-end supermini commonality.

'All points on a compass'

"The 360 was a machine useful for all applications, all points on the compass. To a close order of approximation, any program that ran on any 370 will run on today's 370s. If you had a Fortran compiler that you developed in 1965, you could run it on today's 3090s," says Richard Case, IBM director of technical personnel development and a participant in the 360 and 370 development projects (see story page 182).

The 360 introduction was

made at a time when the computing world was vastly different than it is today. Case points to an IBM Personal Computer in his office and says with a laugh, "You'd pick a personal computer to do everything the 1401 did. The only thing 1401 had that was better than what this device on my desk has was a better card reader."

With the 360, IBM introduced a line of peripherals, but it was with the 370 announcement in 1971 that IBM established standards for peripherals that remain in use today. With the 370, IBM introduced the 3330 disk drive, with three times the capacity of its predecessors, and 3270 terminals, which offered 24 lines instead of the earlier 12-line displays.

Plug-compatible industry born

The common peripheral interface spawned an industry, a plug-compatible business where start-up companies could design peripherals, secure in knowing they would not be made obsolete by IBM's next mainframe announcement, Case recalls.

While the 360 introduction is acknowledged to be important because of the compatibility, the 370 was important because it opened up the world of virtual memory.

International Data Corp. Vice-President John Hart, who sold the 360 and 370 during a long IBM sales career, notes that General Electric Co. beat IBM to market with its first virtual system, and that IBM then almost overnight developed the 360 Model 97 with virtual memory capabilities as a bridge to the 370, a system on which virtual storage was a prime selling point.

"The move from the 360 to the 370 was less dramatic than the original announcement. It was primarily an implementation of virtual storage. At that point, memory was still a precious resource, and IBM's solution was virtual storage. They said, regardless of the amount of real storage you have, we can make your machine look like it has more," Hart says.

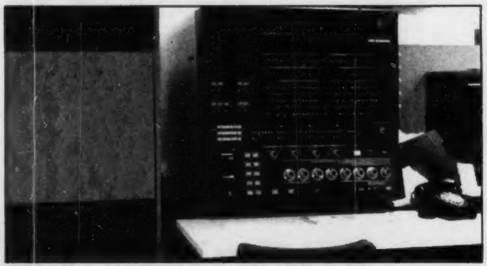
The peripherals announced with the 370 and the virtual capability combined to support the interactive processing that became popular during the 1970s.

The real gamble

But Hart notes that it was the 360 that was the real gamble. "With the move from where they were to the 360, IBM almost bet the company on that one. The attempt to have a new architecture, new software and new technologies all coming together at the same time was a major bet-your-company move," Hart says.

IBM had contingency

"The common peripheral interface spawned an industry, a plug-compatible business where start-up companies could design peripherals, secure in knowing they would not be made obsolete by IBM's next mainframe announcement."


The 370 opened up the world of virtual memory.

plans for the 360 failing, such as new 7000 systems. But if they were to go ahead with the architecture and software for a 360, that would do no good if there was no new chip on which to implement them.

Hart reports that, in general, the three elements came together, although some high-end 360 models were not ready for delivery on schedule.

'Tough sledding'

"Initially, it was tough sledding. The customers embraced the 360 conceptually and they supported IBM in the idea of a compatible family. But in terms of hardware and software, there were lots and lots of problems."

Some systems had to be to-

"The attempt to have a new architecture and new software at the same time was a bet-your-company move."

tally repopulated, with all boards replaced in all models of a line. Compatibility problems did arise with having two operating systems, OS/360 at the high end and DOS at the low end.

"As you moved up the line, you had to convert from DOS to OS, and the early versions of OS were really bad. That was the penality they paid for delivering ahead of schedule," Hart says, emphasizing that most problems were taken care of in a matter of months.

He recalls that IBM set up "war rooms" to deal with daily status reports that were filed by service representatives at each 360 installation.

Case points out that not all of the 360 customers made full use of the new architecture immediately. He

Continued on page 187

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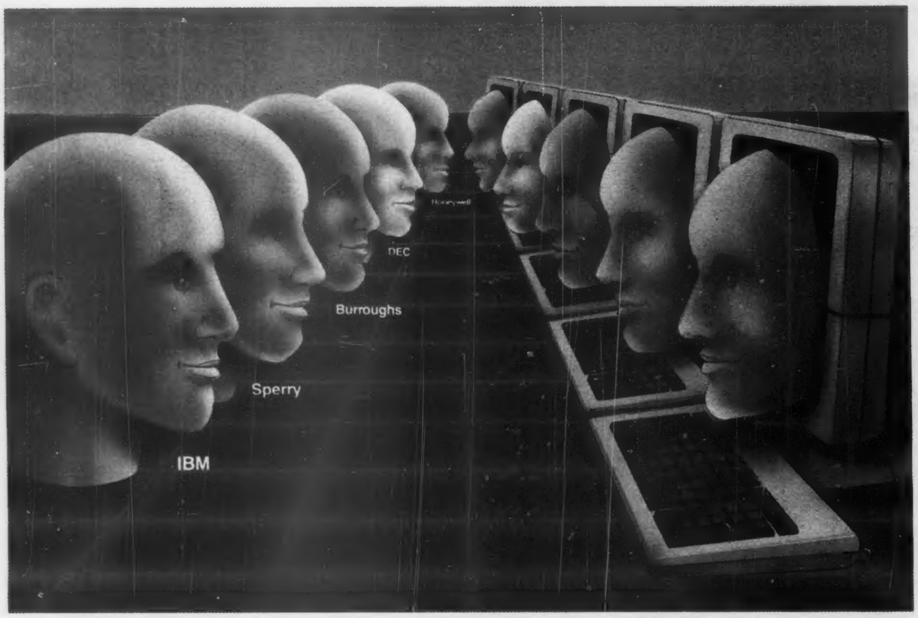

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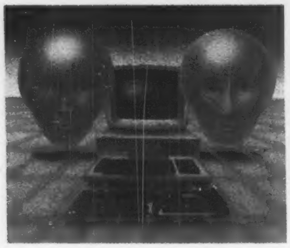

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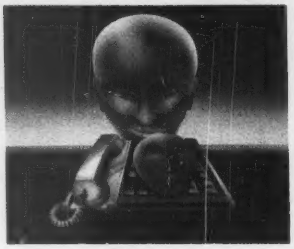

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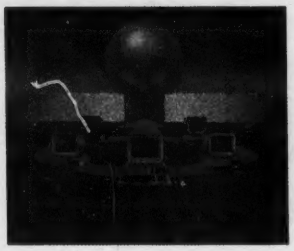

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Glory days: Recalling the shift to a single IBM architecture

Participants agree current dominance began with 360

International Data Corp. Vice-President John Hart, who sold the 360 and 370 systems during a long IBM sales career, recalls that the 360 project was the first attempt to offer users a common architecture.

"The reason for the 360 was to provide one single, common architecture for all of the markets that IBM sought to serve. That had never been done," Hart says, noting that IBM's pitch to customers was to ask them to make one last painful conversion, after years of running multiple architectures and changing to new architectures.

A key element of the 360 architecture was the use of 16 general-purpose registers and eight floating-point registers, although additional registers were present but not used in the early systems. Those registers and the addressing scheme have basically remained constant throughout the 360, 370, 3030, 3080, 4300 and 3090 series product cycles.

Former IBM engineer George McQuilken notes that the 360 project came about because IBM lacked a coherent product line and that IBM at the time was feeling competitive pressures from vendors such as Honeywell, Inc. "The 360 was extremely successful. It really paid off. That's where IBM started its current dominance of the mainframe marketplace," he says.

At the time of the 360 announcement, IBM offered several large systems product lines. IBM's 1401 and 7080 both served the commercial market, but they were incompatible with each other. The 7090 was a high-end scientific system and used a third architecture. However, the 1964 product lines did not present the minicomputer and compatibility issues of today's IBM offerings because all of the 1964 processors were targeted at large companies, which today would be classified as mainframe shops.

Richard Case, IBM director of technical personnel develoment and a participant in the 360 and 370 development projects, says that there was some user hesitancy about moving to a new architecture.

"The customers have always been concerned about going to a new architecture and, at the same time, customers have always been concerned about not going to a new architecture," Case says, noting that new architectures appeared every few years before the 360 team was formed in 1961. But in 1964, users had little choice about converting.

The IBM 360 in action.

"All of the predecessor systems had run out of addressing space and had run out of memory. It was clear that the technology had made more memory possible, and the customers had made it clear that they wanted more memory," he adds. Maximum memory on a 7090 was 128K bytes, IBM's Case says. In contrast, the first 360s had the potential to address 16M bytes of memory; today's uniprocessor 3090s support up to 64M bytes.

Running 1401s and 7090s in a single company meant customers had to maintain separate operating staffs and separate software libraries.

Key members of the 360 team assembled in 1961 included IBM executives Fred Brooks, Gene Amdahl and Gerrit Blaauw.

Now president of Boole & Babbage, Inc. and also a member of the 360 team, Jack van Kinsbergen recalls that the 360 offered two main advantages for users.

"One was the predictability in terms of what IBM is going to do. It's kind of like building an automobile and knowing that you're going to be able to buy plugs and tires and spare parts and batteries that will continue to fit in the future," van Kinsbergen says. He reports that the second advantage was preservation of user investments in applications because users could know that software developed for one machine would run on the next generation of systems.

"Early on, customers were spending more time converting from one generation of machine to the next than they were building useful applications. Every generation was different. Now, users know they can make an investment and be able to recover it over time," van Kinsbergen recalls, noting that latter-day users take software continuity for granted.

But van Kinsbergen adds that what might surprise today's user is that IBM pioneered the concept as a convenience for IBM rather than for the customer.

Maintaining separate product lines meant that IBM needed separate development, sales, engineering and support staffs for each machine. "As a result, internal expenses were growing faster than revenue. They just couldn't afford to keep going they way they were going," van Kinsbergen reports.

The 360 project was also a major step for IBM because of the capital investment involved. It was the first IBM project to require major financial backing from outside the company. It also was the first system for which IBM built its own parts rather than relying on component suppliers.

Hart says that one of the key difference between the 360 and earlier IBM and non-IBM systems was the 360's use of multiples of eight in the system design. Major vendors tended to use six-bit and seven-bit addressing schemes, but the 360 sped the shift to eight-bit addressing.

The 360 also bridged second- and third-generation computers. Hart and Case describe the system as a second-and-a-half-generation system because it used solid logic technology transistors like the second generation and a limited number of the integrated circuits that marked third-generation systems.

For all its advantages, the architecture also has at least one drawback, van Kinsbergen notes. "If you're a customer, you're kind of at IBM's mercy from a pricing and marketing point of view and are in lockstep with what the company decides to do. Your needs may be entirely different from IBM's needs. You may not be able to get some things you want because IBM isn't convinced it can make money from them."

— JAMES CONNOLLY
and JEFFREY BEELER

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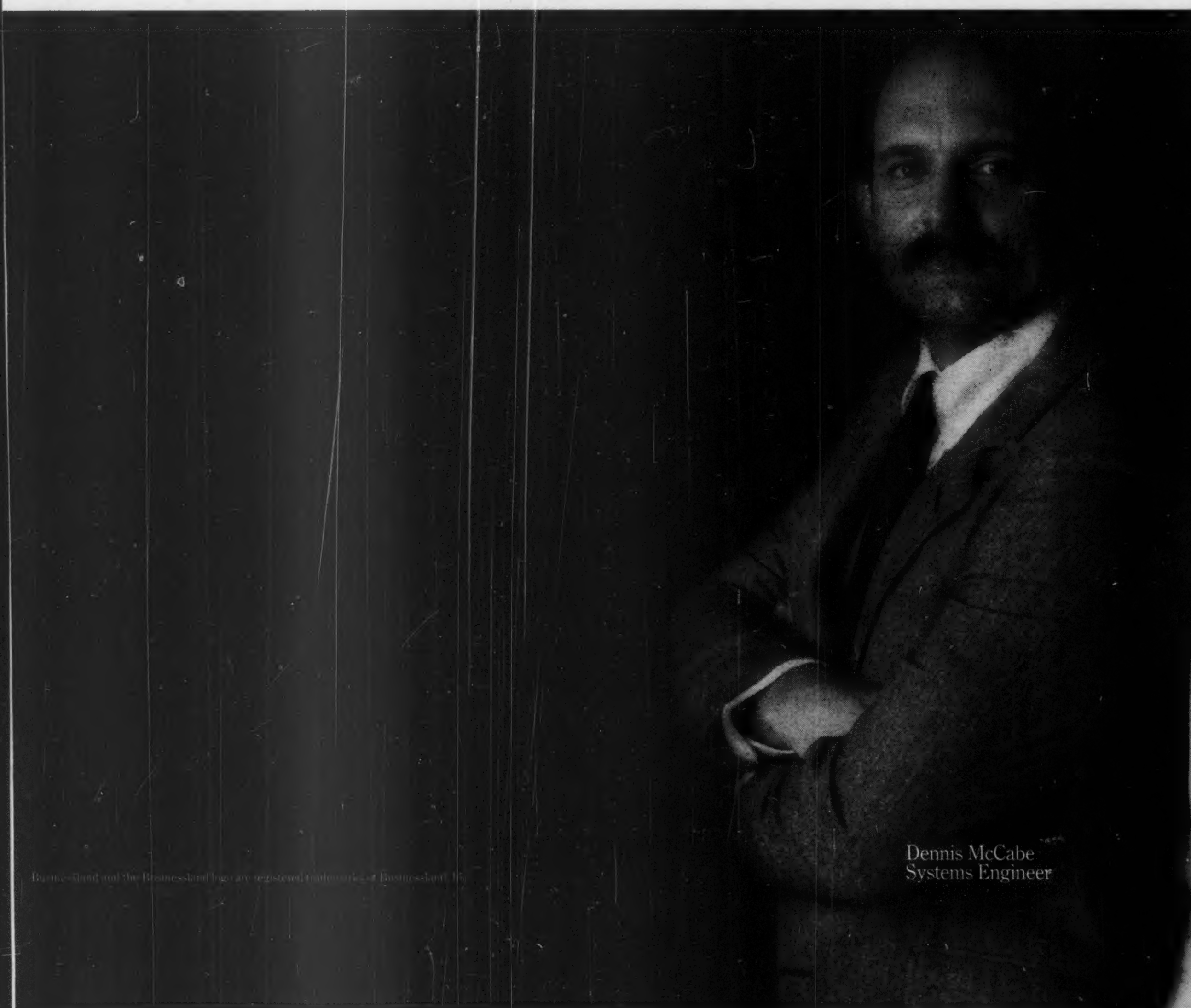

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Continued from page 181

says that emulators that allowed 360 customers to run programs from the older systems sold well.

"The 7080 emulator ran at a 1-1 ratio, while you could have gotten a 3-1 ratio by running as a 360. But somehow we sold twice as many emulators as we sold of the original 7080. Those emulators allowed people to preserve their old programs." He notes that some people used emulators for years on 360s.

370 scrapping unlikely

Hart, Case and Jack van Kinsbergen, a member of the 1961 360 team and now president of Boole and Babbage, Inc., concur that IBM is unlikely to scrap the 370 architecture in the near future, at least not in the way they dropped the 1401 and 7090 in favor of the 360.

Case notes that even if IBM did introduce a new architecture, emulators would be more important than ever.

He also speculates that if IBM ever introduced a new architecture, it would continue to support and enhance the 370 machines.

Van Kinsbergen says that while the architecture has expanded to accommodate concepts such as multi-

Boole & Babbage's van Kinsbergen

processing, the design will stretch even further to support features such as parallel processing and other fifth-generation capabilities.

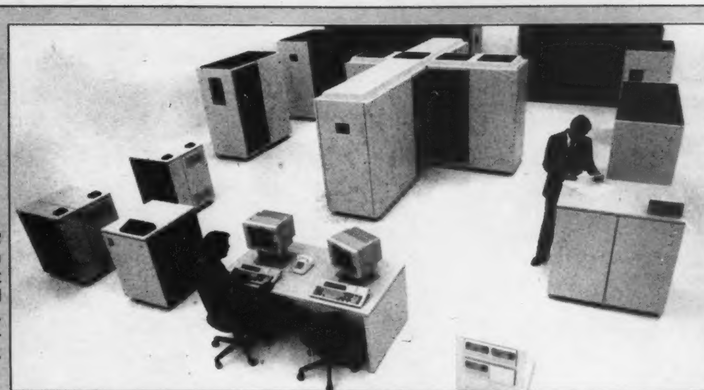
More user-friendly

Hart adds, "I think that what IBM is going to do is stay with the basic 370 architecture while looking at trying to come up with a new, more user-friendly operating system without hurting the billions of dollars of applications software that is out there."

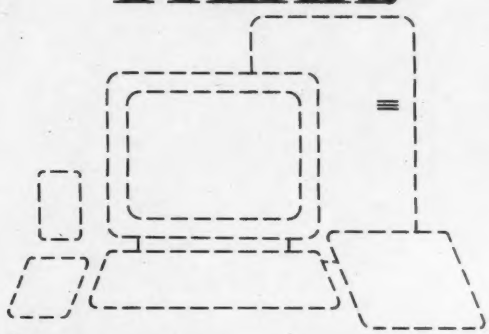
When asked if IBM succeeded in its goal of offering a top-to-bottom compatible architecture, Case notes that the 360 line failed to extend far enough down to be affordable to some potential customers at the low end. But he says that it was successful otherwise.

Hart says the project was successful in that it offered compatibility to large users, who were the only companies that could afford computers 22 years ago.

But he also looks at the minicomputer arena and adds, 'As it turns out, IBM lost everything they once achieved in terms of compatibility because they have now proliferated four or five families." ■



3090 VECTOR Facility, contained in cabinet forming right arm of "T"-shaped processor (center), runs engineering/scientific programs.



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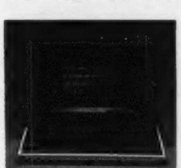

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Rumors rampant on IBM mainframe architecture

By ROSEMARY HAMILTON

IBM's plans for its mainframe architecture have been the subject of wide-ranging speculation among industry observers and analysts, but there is a strong consensus among users that the 22-year-old architecture will endure for years to come.

"It's unthinkable to me," data processing manager Karl Kasten says, when asked if he expects IBM to debut a new architecture with the introduction of its next generation of mainframes. Kasten, a vice-president at American States Insurance Co. in Indianapolis, oversees an IBM 3090 Model 200 installation.

Among IBM observers, however, are those who argue that the life cycle of the current mainframe architecture is coming to an end and that it will give way to a newer, more technologically advanced architecture. But there are also those who are just as adamant that IBM would not risk alienating a software base that by now represents billions of dollars.

In 1985, approximately $4 billion worth of software was purchased for large-scale systems, the majority of which are IBM System 370-based machines, according to International Data Corp. (IDC), a market research firm in Framingham, Mass. According to Ted Jastrzembski, director of IDC's software research programs, of the estimated 19,800 large-scale systems installed as of 1985, 14,800 were IBM machines.

Differing opinions are represented by the founders of Software Productivity Research, Inc. in Cambridge, Mass. T. Capers Jones, a software maintenance expert and chairman of the firm, suggests that conventional large-system architectures are quickly reaching their limits and that research in parallel processing could "have a very profound impact on both hardware and operating systems."

But when his partner, ex-IBM employee George McQuilken, was asked about the possibility of IBM changing the current architecture, he said, "What will happen is IBM won't sell any of those machines unless they run the very same software."

Based on a series of interviews with DP professionals, the user community appears more aligned with McQuilken's thinking. Users say they expect the basic mainframe architecture, which officially began with the debut of the IBM 360, to endure. They predict that the next generation of mainframes will be an enhanced version of the current high end, the 3090 Model 400.


The IBM 9370 Information System.

"Our speculation is that they would not make a big change, at least not with the Summit," Gary Hudson says, referring to the code name for the next line of IBM mainframes. Hudson, who is a hardware and software analyst at Blue Cross Blue Shield in Topeka, Kan., says that "there is so much speculation in the market now, I don't know what to believe, but we're thinking that the Summit will be a performance improvement to the 3090s."

Because of his current computing needs, which are served with an IBM 3084 Model Q, Hudson says that "we wouldn't need the new architecture. The only reason we would is if we were forced to move to that."

According to John Owens, a senior vice-president at Shearson Lehman Brothers, Inc., a radical departure from the existing IBM architecture would be like "IBM coming out with a Burroughs or a Honeywell system."

To Owens, the architecture of the new mainframes is a pressing concern because he expects his current

Continued on page 193

Recalling 18 years of dramatic DP changes

American Express's Earle

By DONNA RAIMONDI

When R. Edwin Earle started his career in data processing in 1968, he managed an Ohio bank's mainframe computer that had 19.2K bytes of memory.

In the ensuing 18 years, system speeds have increased dramatically. "Today, you can get a personal computer with 640K bytes," he says. "And, just as dramatically, size has come down, reliability has gone up and relative costs have come down," says Earle, who is now vice-president in charge of computing services at American Express Co. Card Division.

Those factors are true for CPUs, disk and tape drives and just about any kind of hardware, he adds. In addition, the switch from batch processing to on-line work has been revolutionary.

The Burroughs Corp. B300, on which Earle cut his computing teeth, had to be programmed in either assembler or machine language. "What you see in the past 18 years is that programming went from very low-level languages, very close to the machine, to high-level, fourth-generation tools," he says.

The tools Earle's programmers use now at the American Express Card Division in Fort Lauderdale, where Earle has worked for the last 4½ years, have taken the drudgery out of coding and made maintenance and code changes easier.

"Back in '68, it was almost impossible to debug somebody else's code," Earle says.

Financially based decisions

In the past, MIS managers would run out of computing power and just order another machine, Earle says. But now, decisions are made on financial as well as technological bases. "We lease far more machines, and we lease them for much shorter periods of time. What we try to do now is remain flexible in terms of being able to change."

American Express already has an IBM 3090 Model 400 — with 128M bytes of memory — up and running and another sitting on the loading dock, Earle says.

"It's kind of crazy. That machine is just now becoming generally available, and we are talking about whether we really want to have a four-year lease on it. . . . We want to be positioned in 1990 to be able to change in case some newer technology comes along."

The importance of the computer system to the company has certainly changed during Earle's career. "American Express has probably 8,000 to 10,000 employees who cannot do their job if we are down, whether the problem is with the disks, CPU or data base," Earle says.

Requires 99.9% uptime

The employees work on-line answering card holders' questions, calling card members whose payments may be past due, resolving written correspondence and making sure American Express is complying with all its written rules and regulations. The company requires 99.9% uptime to avoid the financial catastrophe of having its workers idle.

"In the late '60s, you automated accounting processes. It was all batch processing," Earle says. Back then, computers had excess capacity in the daytime and were bound up at night by all the batches.

Today, computers are used most heavily on-line in the daytime and have excess capacity at night.

"Twenty years ago we crunched numbers. Today we provide information to people who look at that information and make decisions. And we are starting to look at artificial intelligence and expert systems to capture the decision-making process and eliminate the middle step. Whether or not we actually accomplish that is an open question, but I see it as the new horizon," Earle says.

Hardware reliability improved

Hardware reliability in 1986 is almost unbelievable, Earle states. "If our system goes down once a year now, that is a lot. Eighteen years ago, if the system went down once a week, you were lucky."

In tape drives, IBM 3480s are 10 times more reliable in temporary read or write errors than IBM's 3420s, Earle says.

But that is just a recent change. Tape technology has changed the peripherals least of all, he says. Until the 3480 cartridges became available

Continued from page 191

hardware to sustain his organization for "another 18 months or couple of years, at the rate we're going." Owens' shop has two recently installed 3090 Model 400s, as well as one 3090 Model 200 and one 3084.

"If IBM made a major change, there's no way I could easily do it," he says. "There would have to be transition vehicles or else it would be like changing vendors.

"I think they'll introduce evolutionary changes, ones that don't affect the users too greatly," Owens continues. "I just moved from two 3084s to two Model 400s over the weekend. That kind of a change I can handle."

Like Owens, Kasten at American States Insurance expects evolutionary changes. "Evolution you can cope with, like your normal software migrations. You can take the time to plan and schedule them. But you can't change 25 years of software development. And why would I want to reinvent 25 years?" he asks.

A similar opinion is expressed by John Wolfe, director of advanced systems research at the Cigna Corp.'s data center in Windsor, Conn. "I suspect there'll be minor changes that would be transparent to the users, or a situation where we could operate in compatiblity mode for a number of years."

The Windsor facility is one of three Cigna data centers and it houses a 3090 Model 400, a Model 200, four 3081s and one 3084. When asked what it would entail to convert this installation to a new architecture, Wolfe said, "I have absolutely no idea."

> *'Evolution you can cope with, but you can't change 25 years of software development. And why would I want to reinvent 25 years?'*
>
> — Karl Kasten
> American States Insurance Co.

"It would be unbelievably costly," he added. "We have millions and millions of lines of code. The cost would be astronomical."

Nonetheless, Wolfe acknowledges that the current hardware "is really being pushed" and he says he is hoping IBM will make a technology leap or advancement.

"We are looking to some very big on-line needs, and the current hardware probably can't grow that big," Wolfe says. "We're hoping that IBM finds a way around it, and I have a comfortable feeling that it won't be a radical change."

Of the group of data processing professionals interviewed, one user, a hardware services manager at Security Pacific National Bank in Westminster, Colo., says he would welcome a major architectural change from IBM.

"I think it's inevitable," Security Pacific's David Hefler says. "At some point in time, we'll have to bite the bullet."

Hefler says he is waiting for a mainframe-based image processing system from IBM to improve check processing at the bank.

Hefler works at one of Security Pacific's data centers, where a 3090 Model 200 and two 3081 Model Ks are used primarly for check processing.

"We're talking a major rewrite, but at some point in time, we'd have to make the decision to do it," Hefler says. "It would be a massive, massive job. We do more than a million checks a day. But changes are inevitable. You expect changes. That's the nature of the business." ■

Continued from page 192

last year, tapes had stayed much the same during his career.

Disk drives, used only to store the operating system in 1968 because of their high cost, are now routinely employed for important data sets. "Today, you make a trade-off. You can have the flexibility of having something on disk and weigh it against having it on tape where a human has to go get it."

Since Earle started at American Express, the company has changed IBM 3350s with a total capacity of little more than half a gigabyte to 3380s with almost 1.5G bytes, he says.

Managing the computer center, formerly the province of technical staff who came up through the ranks, is now accomplished by people with MBA degrees who often have to be trained in technical matters. "We don't manage the purely technical like we used to," Earle says. "We tend now to manage work flows, scheduling, process controls. Things that take general business management skills as opposed to technical skills."

Even the end user has changed. "At American Express, we have a fairly sophisticated end user who understands what the machine can do. If they have a problem, they recognize whether it is procedural or really a problem. They are very participative in the change process brought about by DP."

In the late 1960s and early 1970s, there was a wider gulf between the end user and DP. "The user said, 'I know what I want; you go program it. If it doesn't work it is your fault,' " Earle says. ■

Lancaster: Limelight to loner after TV Typewriter stardom

By DAVID BRIGHT

Don Lancaster describes himself as a loner. Despite designing a television display generator in 1973 that computer hardware inventor Lee Felsenstein calls "the opening shot of the computer revolution," Lancaster has remained secluded in a small desert town in Arizona, running a one-man operation called Synergetics. He's kept himself immersed in a variety of computer-related projects, including writing computer cookbooks and magazine columns, creating hardware and informational software, operating a laser printer typesetting service and teaching at a local community college.

He spends his spare time as a fire department training officer, bicycling, "crawling around in caves" and traveling in the Southwest "questing Tinajas," a regional pursuit involving the search for a mysterious rock basin at the bottom of a canyon. "We don't want to define it. Just let them worry about it," he jokes. From his home in Thatcher, Ariz., he keeps in touch with the rest of the world through a Help hotline for specific Apple Computer, Inc. products, on which he receives as many as 60 calls per day.

MICRO PIONEERS

When Lancaster's low-cost TV Typewriter design for displaying alphanumeric data on a television screen appeared in the September 1973 issue of *Radio Electronics*, it sparked a tremendous amount of interest. The magazine normally received no more than 10 letters in response to an article, but thousands of letters poured in requesting Lancaster's instructions for building the $115 TV Typewriter.

The design inspired several other pioneers to advance video technology, including Apple co-founder Steve Wozniak and Felsenstein.

Lancaster has been operating under the Synergetics name since 1965. Among his books are *The RTL Cookbook*, *The TTL Cookbook* and *The CMOS Cookbook*. "Just about everyone who designed the earlier personal computers did so with these books on their desks," he says. More recently, he has written *The Apple Assembly Cookbook* and *The Applewriter Cookbook*.

He sold electronics kits through the mail from 1966 until 1972, when that hobbyist market died down. In February 1968, one of his inventions, which he says was the first reasonably priced digital counter, made the cover of *Popular Electronics*. "It basically started the hobbyist digital electronics revolution that was followed up with all sorts of things like timers, stopwatches and digital voltmeters," Lancaster says.

As one of the original hackers, Lancaster brings much experience to his "Hardware Hacker" column in *Modern Electronics* and his "Ask the Guru" column in *Computer Shopper*.

Nowadays, Lancaster also tests new products for Apple and Adobe Systems, Inc., claiming to have alerted Apple to serious bugs in the Laserwriter Plus. He says laser printers are the "opportunity of the decade." ■

Micral maker opts for optics

In 1973 Thi T. Truong designed a low-cost computer around Intel Corp.'s new 8008 microprocessor. Truong, who was born in Vietnam and raised in France, intended the Micral to replace more expensive minicomputers in lower performance applications. The system achieved a fair measure of popularity in Europe,

MICRO PIONEERS

but it never caught on in the U.S.

Truong produced the Micral until 1979, when he sold the machine to Groupe Bull, one of the biggest computer companies in France, for the equivalent of $25 million.

He then formed Total Telematics Technology (TTT), a Paris-based firm that finances technology firms and develops optical scanning products and a range of IBM Personal Computer-compatible products.

With its first major product, the Lasernet optical scanning system, TTT hopes to carve out a niche as an optical disk pioneer.

Priced at $1,950, the original Micral had 256 bytes of memory, expandable to 2K bytes. During the years, the system was steadily improved, incorporating such additions as a higher memory capacity, floppy disks and hard disks. The Micral was mainly sold to the French government and to industry for process control applications. In 1985, the IBM PC-compatible Bull-Micral system achieved European sales of more than $200 million. ■

Faith required to invest in productivity

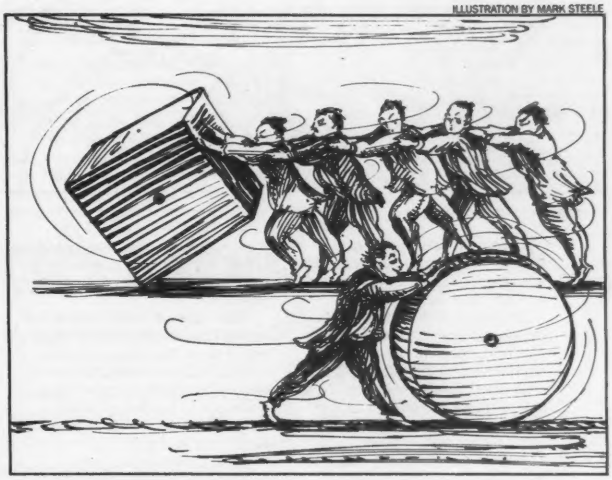


ILLUSTRATION BY MARK STEELE

By DAVID LUDLUM

Office computers have enhanced the productivity of American businesses, even if it can't be proved conclusively.

That's the view of experts in the use of information systems questioned on the debate over what benefits businesses in the U.S. have reaped from their huge investments in office automation.

That ongoing debate was heightened earlier this year with a cover story in *Fortune* magazine that claimed the payoff from hundreds of billions of dollars of investments in office computers by American companies has been "puny."

The article cited an economist's calculation that white-collar productivity in America hasn't advanced since the 1960s. It went on to suggest that the major benefits of office computers lie farther down the road, when business procedures are changed to take full advantage of the equipment.

OA contribution argued

Several academics and consultants surveyed on the issue strongly disputed the conclusion that office automation has not made significant contributions to productivity, although they agreed that technologies have been oversold and that optimal use of them will come with more fundamental changes in the future.

'We have a real managerial challenge on our hands.'

In an enterprising piece of research, Stephen S. Roach, a senior economist at the New York investment banking firm Morgan Stanley & Co., attempted to isolate the change in white-collar productivity in American business from the overall productivity trend reported by the federal government.

In both the service and manufacturing sectors of the economy, "productivity is essentially flat for white-collar workers vis-a-vis the 1960s," says Roach, whose work played a prominant role in the *Fortune* article.

While he concedes that the impact of computers on productivity cannot be measured directly, Roach concludes that there is powerful evidence that, overall, computers have not generated a payback in improved productivity.

Roach concedes that there have been exceptions in some industries, such as financial services, that have been offset by failures elsewhere. But even here, the results have been mixed, he says.

Other observers also question the benefits of some applications of office technology. "Anyone who uses an electronic mail system has to ask himself whether all that communication is really worthwhile. Is it better or just more?" asks Michael Vitale, an assistant professor and information systems specialist at Harvard Business School.

But Vitale strongly disputes the view that white-collar productivity has been stagnant.

"I just don't agree with that argument. My feeling is that overall productivity definitely has been improved in terms of output per input," Vitale says. And computers have played a role in that gain, according to Vitale.

"Look inside any large insurance company or bank, or Harvard Business School for that matter. You just don't see as many clerical heads as you used to, " he says.

Others agree that office computers have enhanced productivity. "They obviously have. Anyone who thinks they haven't doesn't understand how offices work. They're trying to trade on the fact that you can't put a number on it," says William Zachmann, corporate vice-president for research at International Data Corp. of Framingham, Mass.

Users' OA goals

Experienced users of advanced office automation systems look for their equipment to improve the overall performance of a department or organization, rather than the productivity of individual workers, says John J. Connell, executive director of Office Technology Research Group of Pasadena, Calif.

Measuring improved performance can't be limited to reducing expenses, says Connell, whose organization is made up of corporations that use advanced office systems. "The

fact that you save time doesn't mean you save money. You have to ask what the mission of the department is" and look for changes that improve quality of work, he says.

The quality of texts has improved since the days before word processers were used, Vitale notes. "How many times were there when you said you knew you could make an improvement but didn't?" Looking at old case studies, he wonders "how could we ever have produced something that looks that bad?"

Observers say some products and business activities wouldn't be possible without computers. T. Capers Jones, chairman of Software Productivity Research, Inc. of Cambridge, Mass., says he does business and market projections with his computer that he couldn't do without it. Vitale says the market for financial futures contracts owes its existence to computers.

In many cases, information technology has been oversold, these observers concede. But that's because "any new technology that's powerful has a certain tendency to be oversold when it comes out," Jones says. He cites predictions in the 1970s that cars would use turbine engines.

Connell says the ease of using personal computers has been oversold. "There is a long learning curve," he says. "People tend to quit after learning the first application. They went through hell to learn how to do spreadsheets."

Both Roach and those who dispute his view that there has been a minimal return from office computers agree that steps can be taken toward more profitable use of the equipment.

Solutions don't lie in supposed panaceas like networks or fiber optics but in "figuring out how to use them to do what you want to do," Zachmann says.

> ***Several academics and consultants strongly disputed the conclusion that office automation has not made significant contributions to productivity, although they agreed that technologies have been oversold and that optimal use of them will come with more fundamental changes in the future.***

Roach says gains lie with better application software and management. "The emphasis has to shift from hardware to software. And we have a real managerial challenge on our hands. We have managers who don't know how to handle the information flow," he says.

James Emery, professor of decision sciences at the University of Pennsylvania's Wharton School, says payoffs require systems big enough to generate synergy through interconnection of many workers. "There's definitely a scale problem. The payoff comes from interconnection of people. Unless you make a major investment, you're not going to see the payoff," he adds.

He, too, believes gains will come through changes in organization, which he says will take time. "The companies that have made the commitment, I think by the end of this decade, will see a profound effect."

Other companies also will have to gamble to keep up with these leaders, Emery says. "It's going to take a strong leap of faith on the part of management to make the investment. A lot of organizations are going to wait until the leaders have made the case." ■

The gains of automation are here, but who can count them?

Rapid changes afford little time to adapt

By NINAMARY BUBA MAGINNIS

Chrysler Corp. MIS Manager Joe Coletti is quick to say his company's employees are more productive now that computer power sits on most workers' desks. But, he readily concedes, quantifying productivity leaps made over the last 20 years is impossible.

"I don't have the statistics to prove it. It's difficult to quantify productivity," says Coletti, who has worked in MIS for 29 years. As more information systems are installed, automation becomes an integral part of daily business operations, he explains; MIS managers at Pepsico, Inc. and Phillips Petroleum Co. agree with hs view.

Allan Deering, vice-president of management information services at Purchase, N.Y.-based Pepsico, says old computer functions and manual tasks at his company are constantly being updated with new technology. And while individual departments must cost-justify computer expenses by projecting return on investment, there are no companywide statistics to corroborate productivity gains.

> ***'There's a huge river of information floating by, and you don't want to drown in the river. You want to pull certain items out of the river and take some action that is meaningful.'***
>
> — Allan Deering
> Pepsico

Phillips Petroleum Information Services Manager Jim Gottardi echoes Deering. "We know there have been gains, but it's difficult to measure those gains to the bottom line," Gottardi says of the Bartlesville, Okla.-based oil firm. "There are not really any good industrywide measures of productivity, and there isn't any degree of consistency in the industry."

Difficulty in measuring productivity can be attributed partly to the way computing evolved over the last 20 years, managers say. "Twenty years ago, end-user computing wasn't even a term," says Pepsico's Deering, a 30-year MIS veteran.

"Those of us who worked in the industry did not ever foresee that happening," he adds. "Back in those days, data processing was basically done in the back room. The only thing users saw was the end product — a printed report. They did not understand how it happened. Most users wouldn't understand an application, particularly with punched cards."

Suddenly, end-user computing caught on like wildfire, leaving very little time to adapt or to measure changes. "MIS first pushed information systems to end users," Coletti recalls. "All of a sudden the end user became impatient with delays and wanted more information systems." End-user computing improved productivity instantly while also presenting new problems, he says.

Phillips Petroleum's Gottardi says that as technology evolved, accuracy increased. "I think we all knew keypunch cards would have to go in order for more efficiency in data processing. Today, an awful lot of data entry will be done by the person who is originating the data. In the 1960s, that person would have filled out a form and sent it off to be keypunched."

"Today we have thousands of people who work daily with computers," observes Deering. "There are so many basic applications that we take for granted. Everybody's been impacted."

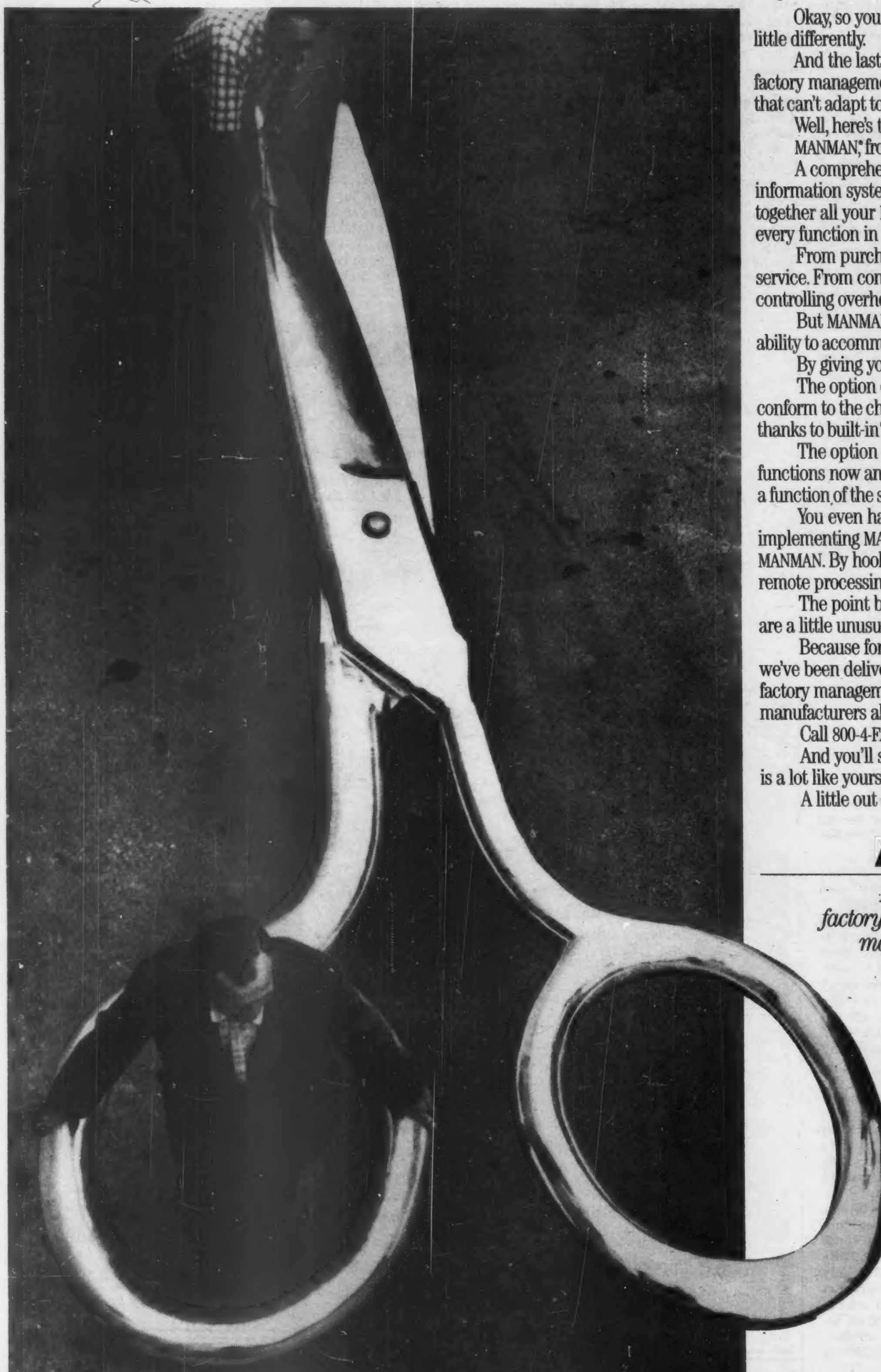
Making systems count

Even with information systems a pervasive presence today, it is important not to install them for the sake of having them, Deering says.

"Our goal is to take data and put it into a meaningful form and give it to our users. There's a huge river of information floating by, and you don't want to drown in the river. You want to pull certain items out of the river and take some action that is meaningful."

Looking to the future, as distributed processing spreads, departments using computer technology have to avoid becoming miniature MIS organizations, according to Chrysler's Coletti. An accounting department should not be inundated with data processing methodology, but accounting processes, he says. "There's been a conservative movement to slow down and put more intelligence into how we're going to progress into the office of the future," Coletti says. ■

Have you resisted getting a factory management system because your manufacturing needs are a little out of the ordinary?



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Making factory management manageable.

Telecom managers grateful for the options of competition

By STANLEY GIBSON

Forty years ago, even an expert at picking dark horses would have hesitated to bet that telecommunications management would one day rise to join the most important of corporate departments. But telephone industry deregulation has grabbed it from the shadows and thrust it into the spotlight.

As recently as 20 years ago, telecommunications management was a tranquil realm, with one supplier and a captive market. The sole supplier, AT&T, dictated products, services and prices. Telecommunications managers either ordered or didn't.

Now, telecommunications managers are free to choose, and that has made all the difference. Telecommunications managers gain prestige by saving money and improving performance in a realm that is of strategic importance to their company.

Prince Dyess, telecommunications manager for the Scripps Clinic in La Jolla, Calif., and president of the Tele-Communications Association, says, "It makes my job a helluva lot of fun.

"Before, there was no choice and no decision. The only question was, 'Can you pay for it?' The analogy in the computer realm is a world with only IBM and no Control Data Corp. or Digital Equipment Corp. *And* the vendor is protected by the federal and state governments," Dyess stresses.

"It's better now. It was very frustrating then," says Bob Hynes, telecommunications manager for the *Los Angeles Times*. "I wasn't really happy with the way it was then. The pricing of regulated equipment was troublesome. Now you have options, and you can buy your own system. Everyone talks about return on investment in buying vs. leasing equipment. You can prove it is less expensive to buy almost all the time," Hynes says.

Beginning in the late 1940s, the forces behind telephone industry deregulation have proceeded inexorably. In 1949, the U.S. Department of Justice filed an antitrust suit against AT&T, aimed at splitting it from its manufacturing subsidiary, Western Electric Corp. That suit resulted in the Consent Decree of 1956, which allowed the telecommunications giant to keep Western Electric, but prohibited it from entering the data processing business.

In 1957, users gained the right to attach their own equipment to the phone system when Hush-a-phone Corp. won a suit against AT&T. In 1968, the Carterfone Communications Corp. decision expanded the range of devices that could be connected.

AT&T lost its monopoly of the private line market in 1969, when the Federal Communications Commission allowed MCI Communications Corp. to serve as a specialized common carrier, offering private line service between St. Louis and Chicago.

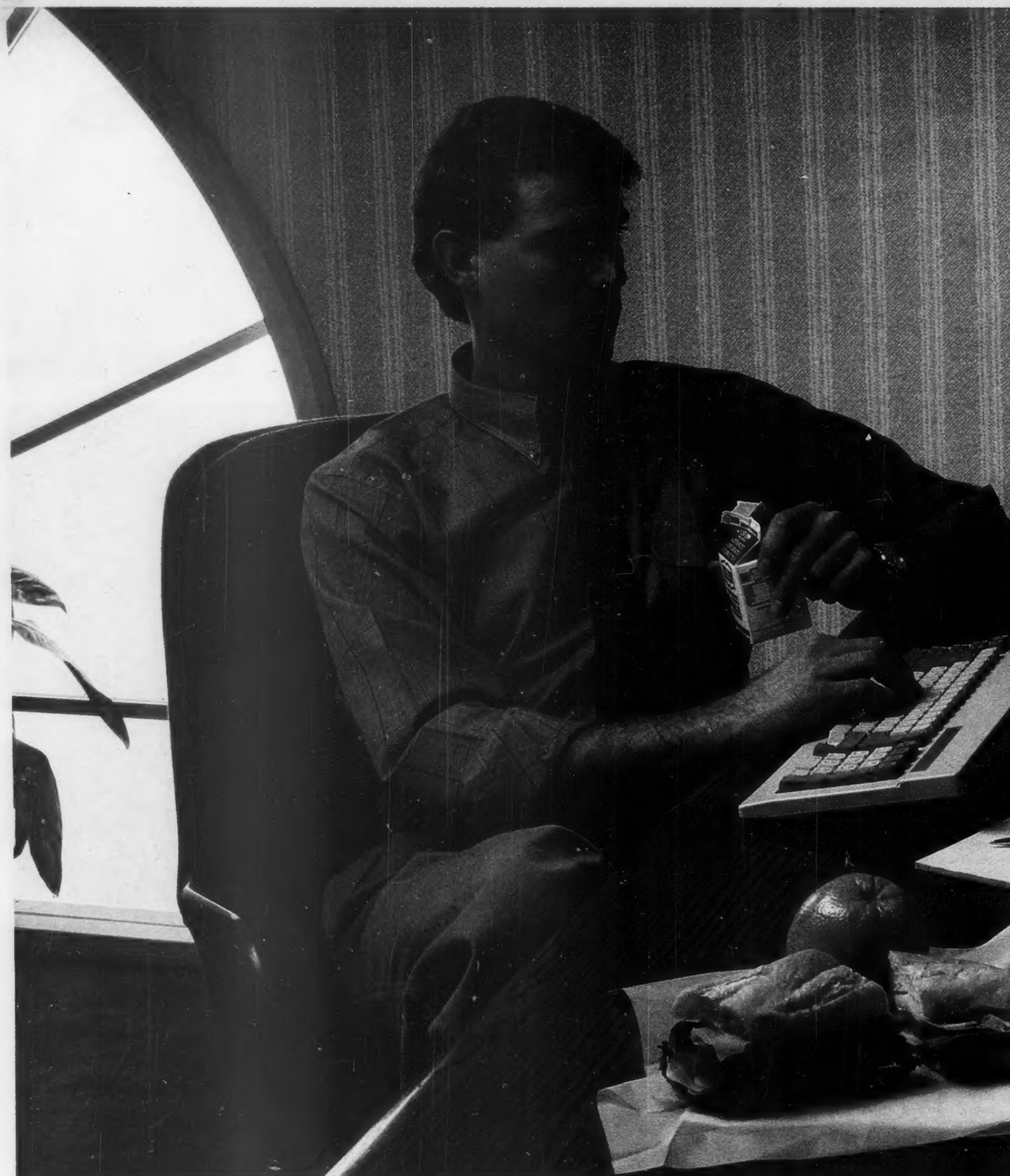
In 1982, the Modified Final Judgement of the 1956 Consent Decree between AT&T and the U.S. Justice Department set in motion the divestiture of the world's largest corporation.

"The single most important event was the Carterfone decision. It allowed users to attach their own equipment to that of the phone company," Hynes says. After Carterfone,

Continued on page 202

'Before, there was no choice and no decision. The only question was, "Can you pay for it?" It's like a world with only IBM and no CDC or DEC.'

— Prince Dyess
Scripps Clinic



> *'Beginning three years ago, companies had to manage their own networks. Just as corporations had to take responsibility over their own computing beginning in the 1960s, now they have to take over telecommunications for themselves."*
>
> — Lionel Gillerman
> McDonnell Douglas Aerospace Information Services Co.

Continued from page 199

he explains, telecommunications managers had to develop new skills. Now, they have to keep abreast of new technologies and new products to provide their companies with the best service.

They also have had to become demanding customers, insisting on high-quality service from a variety of providers. And telecom managers have become more involved in the government regulatory process, Hynes says.

"Communications now is very much like the computer industry in the early '60s," says Lionel Gillerman, manager of network technology and network services for McDonnell Douglas Aerospace Information Services Co. in Cypress, Calif. "Beginning three years ago, companies *had* to manage their own networks. Just as corporations had to take responsibility over their own computing beginning in the 1960s, now they have to take over telecommunications for themselves," he says.

Although they now find themselves in the vortex of high technology, many telecommunications managers entered the field almost by chance in quieter days. "Almost all of us got into it by accident somehow," Hynes says.

Today, in contrast to earlier years, a specialized education in telecommunications management helps aspirants enter the field. Veteran professionals Gillerman and Hynes both teach courses at the university level.

One of the issues they try to impress upon their students is the need to communicate the strategic importance of their field to their corporate leaders. "In a lot of organizations, there seems to be difficulty in making top management aware of the strategic implications of telecommunications," Gillerman says. "In the past, if you needed a telephone, you ordered one. Now it's part of a complexity of corporate systems."

Walt Disney Pictures' Fitzpatrick

"It's important to become part of the long-range planning within the corporation — selling the need, the importance, of telecommunications within the company," says Sheryl Fitzpatrick, telecommunications manager for Walt Disney Pictures in Burbank, Calif. "Most of all, we need persistence in getting our message across."

Dyess, however, says the trend is to overcome the pitfall of being engulfed in corporate bureaucracy.

"The problem seems to be solving itself, especially where the company depends on telecommunications," he says. "They know the amount of money spent on telecommunications is very large, but they also know it saves money for the company."

And that bodes well for career advancement for telecommunications professionals. "You see a lot more telecommunications managers

rise up to the vice-president level. There's one level between myself and the chief executive officer," Dyess says.

Another issue facing telecommunications managers is the increasing integration of voice and data communications, a trend which has been widely heralded, but which has been slow in arriving.

"Voice/data integration was a really hot go-word for a while. People want to learn about it, but it's only applied on a spotty basis. There are many good ways to still use voice and data separately without combining them," says George Shriver, manager of telephone inventory systems for the network services group of Boeing Computer Services Co. in Seattle.

The arrival of Integrated Services Digital Network (ISDN) should hasten the combination of voice and data, although it, too, has been slow to emerge. Hynes, like many, predicts the eventual arrival of ISDN, although he sounds a cautionary note.

"ISDN is coming. But it may be like videotext. There is a question of who will pay for it," he maintains, suggesting that users will resist footing the bill.

Dyess agrees, seconding the notion that the telecommunications user is the final arbiter of change in the field. "If it demands too expensive a renovation — we won't buy it," he says.

Additionally, the integration of voice and data may lead telecommunications and data processing de-

Lionel Gillerman

partments to merge.

"Overall, it's in a state of flux. It's evolving toward something. What's going to happen in the end, I don't know. But if you viewed the telecom end as opposed to the computing end, the telecom end would be viewed as the upstart," Gillerman says.

Hynes, however, boldly predicts the eventually combined department will be known as the communications management department. But whatever the outcome, telecommunications and data processing are increasingly working together. "We are tryng to cross-educate and work together. Our projects demand that the two groups work together. People have to bend a little," Hynes says.

Another significant trend is the increase in artificially intelligent network management stations.

Networks to grow

Research indicates that networks will grow more numerous and complex in the future and that they will expand ahead of the supply of qualified network managers.

"Its just part of the trend to intelligent robots everywhere. We do need telecom management systems and we are buying them in order to control staff size," Hynes says.

As networks become more complex, some see them as superseding in importance the computers they connect. "We've come full circle from computers to communications," Gillerman asserts. "In the past, computers fed networks. Now, the network is central and the computers are nodes on it." ■

'Voice/data integration was a really hot go-word for a while. People want to learn about it, but it's only applied on a spotty basis. There are many ways to still use voice and data separately without combining them.'

— George Shriver
Boeing Computer Services Co.

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Where have all the hackers, hobbyists and home users gone?

By PEGGY WATT

Although few realized it in the mid-1970s when the microcomputer first appeared, it was inevitable that the electronic gadgets that amused and inspired the Homebrew Computer Club in what was to become Silicon Valley would move out of garages and into corporate offices.

And they moved into offices in huge numbers.The population of micros in corporations continues to explode, far surpassing the numbers serving hobbyists in their heyday.

According to the market research firm Dataquest, Inc., one of the few research houses that still separately tracks units shipped for home and hobbyist uses, around 542,000 microcomputers went home with hobbyists, whereas 17.1 million went to work in the office this year. It has been more than seven years — even pre-IBM Personal Computer — since hobbyist buyers were anywhere near the volume of corporate purchases, said Norm DeWitt, Dataquest's director of PC industry service.

"The home market probably began to lose its significance around 1978," DeWitt says.

He notes that hobbyists reached their buying height in 1983 (one year before *Time* magazine's "Year of the Computer"), when home and hobbyist purchases numbered 1.4 million, a figure still dwarfed by the 10.7 million micros in business.

Since then, the hobbyist buyers' population has dwindled while the corporate purchases continue to climb — not at the 50% yearly growth of the early 1980s, but enough to keep plenty of disks spinning. "But what really helped move the PC into business was the 5¼-in. floppy disk at a reasonable price and serious business applications — Lotus Development Corp.'s Visicalc and Wordstar. Before that, you had games or whatever you programmed yourself," DeWitt says.

But the hacker — in the traditional meaning of skilled hobbyist, not criminal — is not dead. He has just donned a three-piece suit. "In almost every corporation, there's one or more persons who came up from the hacker ranks, who's there to help people in an informal role or as a representative of the information center," says Steve Mann, who says he held that honorary position at Peat, Marwick, Mitchell and Co. Mann recently left to become a financial computing services consultant. "I think even in the corporate environment, they need hackers," he adds.

The office hackers, obviously, are not the traditional hobbyists. They were probably not among those who sent away for H-10 Heath kits and assembled their own early personal computers. But they are the ones who spend a little extra time stretching and playing with their systems, perhaps driving the MIS manager to distraction — or sometimes being recruited by the department.

"By and large the majority of business users came up from a business or finance or accounting background and, by hook or by crook, learned just enough to get their work done with Lotus or Symphony," consultant Mann says. "They didn't really want to pay attention to what's new in the technology. They want the minimum learning curve to get the maximum leverage out of their work day."

In fact, the hacker mentality might help business users get more from PCs. Training consultant Richard Gillingham, president of Matrix Services, said users who take a just-the-basics attitude are hurting themselves. "I'm a bit of a gloom-and-doom person on this right now, because when you look in a corporation, you find people are not ready to move up, and they even have holes in some of the basics," he told MIS managers at a recent conference.

"Eighty percent of the people use 50% of their software's capabilities. And I think this is generous," Gillingham added. "Maybe 15% of the people use about 80% of their software's capabilities. It's not a criticism of users, but it's the reality of the situation."

Microcomputer pioneer Adam Osborne went from hardware production with Osborne Computer Co. in the early 1980s to software development in his current venture, Paperback Software International, Inc. But he says he has already discounted the hobbyist market and aimed for the business user from the start.

Osborne agrees the hacker's metamorphosis was inevitable. "There are a few little companies that still build kits and specialty boards," he says. "But the hobbyists are sort of the ham operators of the business now."

The hobbyist still plays a role in the industry, Dataquest's DeWitt says. "Hobbyists are often the first to jump on new machines. The Atari 520 ST, the Commodore Amiga — the first buyers were hobbyists. And they're often the first software developers." ■

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Bjorn Nordemo
Vice President
Data Arts & Sciences, Inc.
Weston, MA

Bjorn Nordemo is Vice President of Data Arts & Sciences, Inc. (DASI), a contract software agency based in Weston, MA. Although they place people in permanent positions, DASI most often places 'contract programming personnel' — consultants who fit special niches for short or long term commitments in corporations in the New England area.

"*Our agency specializes in finding computer consultants — designers of systems, evaluators of hardware and software requirements, and computer programmers to mention a few. We recently were introduced to Computerworld as a potential source for finding these consultants,*" states Bjorn. "*I liked the idea because I know Computerworld has a broad reach — from MIS/DP directors to computer programmers, in multiple industries and multiple markets — and that's what DASI needs.*"

"*We had four specific positions for MIS/DP consultants that we needed to fill in northern New England. We used the local newspaper on a weekly basis, but people who are willing to move usually aren't reading the local Sunday paper. So, I felt this was a perfect opportunity to try Computerworld,*" says Bjorn.

According to Bjorn, he's quite satisfied with the results. "*From Computerworld, we filled 75% (3 out of 4) of the positions with the responses from the first week, and the remaining position with the response from the following week. These results alone made my ads in Computerworld worthwhile.*"

And Bjorn also recognizes a second benefit to advertising in Computerworld. "*The beauty of using Computerworld is that it's read by people in the computer industry who have a need for consultants, as well as being read by consultants who need to keep up to date on the marketplace,*" says Bjorn. "*So we not only reach qualified candidates to fill our current openings, but we are creating awareness of the services that DASI has to offer,*" says Bjorn.

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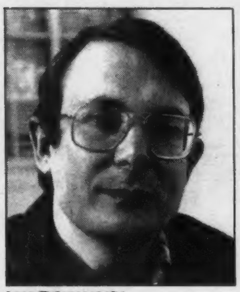
A PUBLICATION OF CW COMMUNICATIONS

After the VDM, Felsenstein is 'having fun' with other projects

By DAVID BRIGHT

Built in 1975, Lee Felsenstein's Visual Display Module (VDM) was the first piece of personal computer hardware providing for a memory-mapped alphanumeric video display. With the VDM board, which Felsenstein says was inspired by Don Lancaster's TV Typewriter, the first low-cost personal computer device that allowed data to be displayed on a screen, personal computers could be used in an interactive, real-time fashion.

The VDM was first built to work with the Micro Instrumentation Telemetry Systems' Altair, and versions of the VDM design soon showed up in several personal com-



Lee Felsenstein

puter systems, including the Radio Shack Corp. TRS-80 Model 1 and the Apple Computer, Inc. Apple II.

Felsenstein is currently in the process of changing Golemics, Inc., the company he originally founded in 1979, from a contract research and development house to one that will focus on his own inventions. "I have various inventions in my notebooks and in my head — and they keep coming out, too — but I've never been able to get around to actually implementing them and selling them," he says. "That is what I really want to do. We are making that move at this moment."

Concerning his latest project, Felsenstein hints that it involves an open architecture supporting the IBM Personal Computer, the Apple Macintosh, the Atari Corp. ST and the Commodore, Ltd. Amiga. He claims that the product, which may arrive by early 1987, will set a new standard.

Two years after founding Golemics, he helped start Osborne Computer Corp. and became its vice-president of engineering.

As the first portable computer, the Osborne-1 portable computer became immensely popular, and gave the personal computer industry a big boost.

Osborne grew too fast, however, and in late 1983 ran into financial difficulties, filing for bankruptcy protection under Chapter 11 of the Federal Bankruptcy Code and later emerging as a different company.

When Osborne faded, Felsenstein restarted Golemics, and in 1984 and 1985, the Berkeley, Calif., company designed a line of IBM PC clones for a Japanese company. Although that company has yet to manufacture and market the machines, Golemics owns the read-only memory BIOS, which could be used in other machines.

MICRO PIONEERS

Felsenstein never asked for royalties from most of the companies that borrowed parts of his VDM design. "I'm just happy that the design has been that robust," he says. Even now, with PCs having skyrocketed to a $13 billion industry, money seems to be a secondary consideration to Felsenstein.

"What we did was largely for the love of it, and I think that shows in terms of what happened and how," he says. "I'm kind of dedicated to bringing back as much of the fun as I can. I want to *have* the fun. Everybody else can have more." ■

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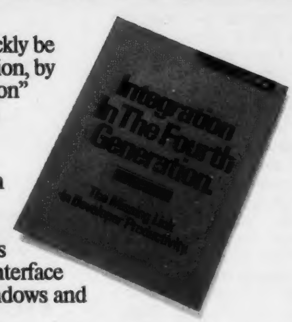

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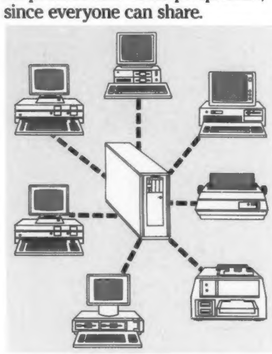

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Hungry giant looms over software marketplace

ILLUSTRATION BY MARK STEELE

By CHARLES BABCOCK

In looking for a relational data base management system, Amex Life Assurance, a division of American Express Co., recently evaluated IBM's DB2 vs. an independent software company's product.

Amex Life found that both DB2 and Supra, a product of Cincom Systems, Inc., "gave us the relational capabilities we were looking for," but Supra had an edge, recalls Jay Kelley, the systems manager responsible for the evaluation.

Because Amex Life does not want to start processing claims for which it does not have policies, it needed referential integrity in its data base. Supra had it; DB2 did not.

Three-scheme architecture

Amex Life also liked Supra's three-schema architecture, which separates external data views from internal data structures, Kelley says.

Finally, Amex Life saw the fourth-generation language, Mantis, that works with Supra, as "a real workhorse," Kelley says, while IBM's Cross System Product is just getting established in the market.

> *'IBM purposely presents a square wheel. They want you to round off the edges.'*

To some observers, the Amex Life deal is typical of the future for the independent software vendors vs. IBM. To others, it is the exception as IBM prepares to push DB2 and other new products into a dominant position, at the expense of the independents.

What is clear at this point is that IBM is intent on increasing its software revenue, with data base management systems one of the more prominent but only one of the areas where it is likely to launch new initiatives. Whether the independent software companies continue to thrive in this climate or find themselves reduced to the status of the BUNCH companies in hardware is a question of overriding importance — not only to themselves but their customers.

The contest actually began 18 years ago when IBM, prodded by critics and antitrust suits from Applied Data Research, Inc. and other young companies, unbundled software from its hardware and a group of technically proficient, hard-hitting software companies grew up to take advantage of the opening.

Today there are more than a dozen companies in the $80 million to $120 million revenue range and a smaller group, such as Management Science America, Inc. (MSA) in Atlanta or Computer Associates International, Inc. in Garden City, N.Y.in the $180 million to $220 million range.

The independents' revenues, which added up to $2.4 billion in the world marketplace in 1985, were still overshadowed by IBM's software revenue of $4.1 billion. That represented only 8.2% of IBM's revenue, but Wall Street analysts believe it represents a significantly higher share of IBM's profits. In addition, software revenue is growing at a rate of 29% annually, while hardware revenue, especially mainframe processors, is believed to be growing in the 6% to 7% range.

Expanding software business

These facts have surely given strategic planners at IBM's corporate headquarters in Armonk, N.Y., cause to consider expanding the opportunities in software. One way is simply to charge more for its huge installed base of systems software, which IBM has been doing in well-publicized examples.

In terms of future expansion, however, IBM appears most interested in creating new hardware opportunities through the availability of software.

Earlier this year IBM signed an agreement with Hogan Systems, Inc. to market its banking software line.Burroughs Corp. and Digital Equipment Corp. have succeeded in selling hardware to banks, and with financial services an expanding sector of the economy, IBM addressed this market from the software side in the Hogan deal.

Scott M. Smith, a former analyst with the Gartner Group, Inc. and now vice-president of Donaldson, Lufkin & Jenrette, Inc., the New York brokerage house, in a talk earlier this year

PACKAGED SOFTWARE: GEOGRAPHICAL DISTRIBUTION OF VENDORS' REVENUES

	U.S. $(millions)	%	International $ (millions)	%	Worldwide $ (millions)	%	U.S. %
1984	8,380		2,730		11,110		
1985	9,720	16	3,500	28	13,220	19	75
1986	11,605	19	4,595	31	16,200	23	74
1987	14,330	23	6,165	34	20,495	27	72
1988	17,905	25	8,375	36	26,280	28	70
1989	22,680	27	11,465	37	34,145	30	68
1990	29,185	29	15,755	37	44,940	32	66
1984-1990		23		34		26	

'Picture John Opel sitting in Armonk, watching his largest customers delay hardware purchases because a banking application is faulty. . . . In many banks, account control rests with Hogan Systems, not IBM.'

— Scott M. Smith
Donaldson, Lufkin & Jenrette, Inc.

to American Management Systems, Inc., said several banks put off buying 3090 mainframes prior to the IBM-Hogan deal because the installation of Hogan software was behind schedule.

"Picture John Opel sitting in Armonk, watching his largest customers delay hardware purchases because a banking application is faulty. . . . In many banks, account control rests with Hogan Systems, not IBM," Smith says.

In striking a deal with Hogan, IBM moved into the banking applications marketplace in a fashion that left some independent applications vendors wary of how forcefully IBM could move into a new arena.

For one thing, Hogan eliminated its domestic sales force, turning the entire marketing function over to IBM.

For another, an independent company turned over its entire product line to IBM for 20 years, an agreement of unusual length.

"Hogan is a trial balloon," said Dennis Yablonsky, president of Cincom Systems, Inc., the Cincinnati systems and applications house.

"If it turns out to be a big success, that would encourage IBM to try again," says Richard L. Crandall, president and chief executive officer of Comshare, Inc., an Ann Arbor, Mich., decision support vendor and professional services firm.

"IBM has come to realize it has to be more aggressive in software if it is going to be able to control its own future stream of hardware revenue," Smith said.

To serve this purpose, IBM established a 120-person IBM Information Services business unit three years ago to sell services from its information network, to sell consulting services and to design or acquire application packages, industry sources report.

The Hogan deal was one of its first moves, says John Imlay, chairman of MSA, who served as the Association of Data Processing Service Organizations (ADAPSO) negotiator with IBM on industry issues.

The special business unit is organizing a software sales force of 30 to 40 people to sell Hogan's line and any future applications IBM wants to give priority to, Imlay says.

He thinks IBM will pursue additional vertical markets and forge alliances with independents to do so.

Robert Berland, IBM's director of strategic planning, acknowledged as much when he addressed ADAPSO earlier this year: "We can't do it all ourselves," he said. IBM is looking for more long-term, working relationships, he said.

Working relationships and joint-marketing agreements with IBM are something many independents welcome. But they are likely to come on the applications side.

Many independents also realize large revenues from systems software, producing utilities or special function add-ons to the IBM operating system.

Every systems software house dreads the moment when IBM goes

after what has become a standard product in the market and makes it part of its basic systems offering.

Many believe that is what it is doing now in the field of data base management.

"Every 15 or 20 years, IBM pushes the independent software vendors one layer further away from the computer and toward the customer," Comshare's Crandall says.

> *'Every 15 or 20 years, IBM pushes the independent software vendors one layer further away from the computer and toward the customer.'*
>
> — Richard L. Crandall, Comshare, Inc.

By establishing DB2 as the primary data base management system, IBM will be able to surround it with tools and applications and graft a new source of recurring revenue to its huge systems base.

Of its $4.1 billion in software revenue in 1985, 68% is estimated to stem from the systems side, primarily operating systems, despite IBM's offering of 3,000 applications.

Imlay is wary of IBM's perennial push deeper into systems.

He says he has intentionally steered MSA away from the data base management system arena and says those who choose to compete with IBM there will not fare well.

Jack Berdy, chairman of On-Line Software International, Inc., in Fort Lee, N.J., a CICS niche systems house, states the case more bluntly:

"Anybody who thinks DB2 isn't here to stay should not be in this business," he warns.

Nevertheless, the data base vendors are not yet ready to concede defeat.

"I don't feel any overwhelming enthusiasm for DB2 out there," says John Cullinane, chairman of Cullinet Software, Inc. If IBM was selling mainframes at a faster rate, DB2 would be more of a factor because it would be going in on them, he adds.

"They do not have that marketplace to themselves," Cincom's Yablonsky says. He says Cincom shipped 175 tapes of its new relational product, Supra, since March and that it is competing effectively with DB2, he says.

"A lot of our Adabas users have tried DB2 and put it on the shelf," claims John Maguire, chairman of Software AG of North America, Inc., which sells the Adabas data base management system.

Many of the statistics that show a large market share for DB2 are really showing overlap where it is being experimented with alongside another primary system, he says.

Couching bravado

But even these vendors are couching their bravado behind caution. Most of the companies have announced SQL support for their query

Continued on page 213

IBM evinces interest in applications software

Management Science looks into lion's jaws

Although IBM is showing a growing interest in applications software, Management Science America, Inc. (MSA) Chairman John Imlay says he does not think it represents a significant threat to his company.

MSA is an established applications vendor in manufacturing, accounting and a number of other vertical markets that IBM might conceivably invade.

"If they came out with a new manufacturing system, they would still have a problem with the user. Forty percent of mainframe users develop their own software. They don't buy packages," Imlay says. He adds that he thinks a strong push by IBM into applications might broaden the market so much that independents would benefit as much as IBM.

Comshare, Inc.'s President Richard L. Crandall points out that the applications business is much more fragmented than the operating systems and utilities that IBM ships across the board to mainframe sites. A successful applications vendor is really supporting a string of products, each representing a $10 or $15 million business.

"To IBM, $100 million to $900 million looks like a niche market. If they move into applications, how much revenue will they get? How do you manage 500 $15 million businesses? I don't see how they can do it," Crandall says.

Nevertheless, Imlay and other observers say both manufacturing and insurance are likely follow-ups to IBM's push into banking through the Hogan Systems, Inc. deal.

Imlay said MSA is competing with IBM now in selling its manufacturing packages against the aging IBM Manufacturing, Accounting and Production Information Control System and Communications-Oriented Production Information and Control System offerings. By continuing to enhance its products, MSA will be able to compete with them in the future, he says.

"In our line of financial applications, human resources and manufacturing, IBM is one of the least of our competitors," he says. In accounting applications, certified public accountants with specific business expertise make up one-third of MSA's development teams. IBM can do the same thing in selected areas, Imlay says, "but they can't be everywhere."

For that reason, Imlay says he thinks IBM will seek alliances with more independent software companies in specific application areas, and MSA itself has agreed to jointly market higher education software from its new acquisition, Information Associates.

'Friendly but independent'

"We want to be friendly to IBM but remain independent," Imlay adds.

On the systems software front, few challenge IBM's dominance. Generating a product comparable to IBM's flagship production operating system, MVS/XA, with six million lines of code, is a task beyond the reach of most independents, who compete on the basis of products with 100,000 to 500,000 lines of code.

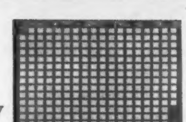
"IBM is probably the only software company in the world that can effectively manage a project on the scale of a major operating system. . . . The typical knock that IBM cannot develop 'good' software is tremendously misleading," says Scott M. Smith, a former analyst with the Gartner Group, Inc. and now vice-president of Donaldson, Lufkin & Jenrette, Inc., the New York brokerage house.

The independents compete with IBM on this front as well and fare more unevenly than in applications. Applied Data Research, Inc. (ADR), for example, came out with its teleprocessing monitor, Roscoe, in 1970, and IBM followed suit with TSO in 1972, recalls Martin Goetz, now senior vice-president and chief technical officer at ADR.

Roscoe is still installed at nearly 2,000 sites, and ADR claims a 10% to 15% market share, to IBM's 75%. "We're the prime alternative to TSO," a satisfactory outcome for most independents, Goetz says.

Another ADR teleprocessing monitor, Vollie, did not fare so well. It competes with IBM's Interactive

John P. Imlay Jr.



'If IBM came out with a new manufacturing system, it would still have a problem with users. Forty percent of mainframe users develop their own software. They don't buy packages.'

— John Imlay
MSA

Continued from page 212

Computing Control Facility (ICCF) and started losing market share in 1981, after IBM introduced the 4300 processor series that included the ICCF that carried a price tag of $60 a month.

"We thought that was predatory and complained to ADAPSO," the association of software and services companies, Goetz says.

'Almost a requirement'

IBM then included ICCF with each delivery of its DOS operating system.

"It almost became a requirement to get ICCF: . . . You had to sign an agreement you would erase it from the tape if you didn't plan to use it," Goetz said, and Vollie's market share declined to 5%.

With some utilities, IBM easily dominates the market once it decides the product is a key offering that will go out the door with each operating system.

But even here many observers think the independents have room to compete.

Still room to compete

"IBM salesmen know how to sell hardware and operating systems tied to processor sales.

"They do not have the appetite to engage in a three- to six-month competitive evaluation for a utility product," Smith said.

The independents, he added, "have carved out high-growth opportunities for themselves, providing utilities that support the core IBM products."

— CHARLES BABCOCK

Continued from page 211

and fourth-generation language products so they will be able to work with DB2.

So far DB2 works only with IBM's largest, most expensive operating system, MVS/XA, leaving a large market of DOS/VSE and VM system users for the independents to address.

Even if IBM comes to dominate data base management systems, many observers think there are still opportunities for independent software companies and that IBM will increasingly count on them to supply the software its customers need.

"I think IBM counts on the independent vendors to fill some of the gaps. IBM purposely presents a square wheel. They want you to round off the edges. It saves them development costs," says Carole Morton, president of the Dylakor Division of Sterling Software, Inc.

DB2, with its lack of a fourth-generation language, data dictionary and powerful user-oriented query languages is an example, Morton says.

IBM moved into banking applications in a way that left some vendors wary of how forcefully IBM could move into a new arena.

Comshare's Crandall says the independents can also find opportunity in providing professional services along with software.

"About 90% of our software sales last year were accompanied by some sort of professional services — installation, implementation and integration. . . . My prediction is that is where the market is headed," he says.

Regardless of where specific opportunities lie, many observers think independent software companies have matured as businesses, a point that will help them in the coming competition with IBM.

"Over time, corporations have been conditioned to buy from the independents," which is one reason why IBM doesn't do very well in applications, Goetz says.

Smith stated: "For those independent software vendors who choose or just unfortunately happen to compete with IBM strategic products, the implications are clearly negative. . . . The DBMS market is the obvious example."

But, he added, independents who deliver products that complement or support IBM's "should see accelerated growth as they ride on IBM's coattails." By improving the ease of use of its operating systems, IBM is broadening the market for applications, which helps independents, he said.

"I'm glad they invented the square wheel. It allows my company to be in business and make money," Dylakor's Morton adds. ■

Arificial intelligence put to productive commercial use

By EDDY GOLDBERG

Artificial intelligence isn't what it used to be, and that's good news for corporate users. After years of exaggerated vendor claims and user hopes, AI is beginning to find productive use in commercial applications.

Much of the early work in AI was pure science, performed on dedicated symbolic processing machines using Prolog, LISP or other specialized programming languages.

But the future of AI in business is moving steadily toward applications that run on existing hardware using today's popular programming languages.

In addition, the ability of expert systems to employ rules or knowledge bases offers a business a way of encapsulating and retrieving the sometimes hidden axioms of its day-to-day operations.

Not only can these representations of human expertise be encoded for future use, but the rule base can be changed as the business changes, without altering every application that depends on it, the experts say.

Another major advantage that AI may yield would benefit end users in corporations. Some observers think the day will come when AI front ends employing natural language or even voice-activated systems will automatically retrieve data and compose reports.

Data base construction

They could also be used to construct data bases and the applications that work with them without requiring professional MIS programmer intervention.

But before commercial organizations can realize these benefits, AI must complete its migration out of the laboratory.

"I don't think I've seen an expert system yet that cannot be written in a conventional language," says Harry Reinstein, president of Aion Corp., though he acknowledges there are cases in which it can make economic sense to use a specialized language. Aion, based in Palo Alto, Calif., is a 2½-year-old developer of expert system application development tools for commercial DP environments.

"It's important to make this technology available in the operational environments that exist today," Reinstein says. He sees a growing role for expert systems embedded in traditional applications, such as a general ledger or accounts payable package, supplied by today's large software vendors.

In the next 12 to 24 months, more expert systems will be packaged so corporations can use them off the shelf, he says.

> *'The real value of AI is that applications are easier to build and maintain. Rather than rewrite the system, change a rule, and the system restructures itself.'*
>
> — Esther Dyson, "Release 1.0" newsletter

According to Bruce Johnson, partner-in-charge, Artificial Intelligence Practices at Arthur Andersen & Co. in Chicago, 20% of AI technology will help with 70% of commercial problems, primarily through use of rule-based systems.

He says he feels, however, the power of AI technology lies not just in rules, but in a number of programming paradigms working together: object-oriented, procedural, rule based and others.

He still prefers PL/1 and Cobol for producing a highly efficient transaction processing system, since many applications already exist. But to understand complex new problems, powerful tools, many of which are written in LISP, speed the design process.

"AI technology is after new problems, trying to take on a whole range of problems that haven't been tackled before," Johnson says.

Many products are coming to market that are written in the C language. Though hardware prices are beginning to show dramatic price drops, vendors of expert system tool environments such as KEE from Intellicorp, the Automated Reasoning Tool from Inference Corp., and Knowledge Craft from the Carnegie Group, Inc. are enjoying halcyon days by maintaining prices in the $50,000 to $80,000 range, says Patrick Harrison, professor in the Computer Science Department at the U.S. Naval Academy in Annapolis, Md.

"As the prices for machines continue to drop, the tools are staying expensive," he says. "Knowledge is expensive."

Another method of adding AI to existing systems is seen in Impact/

Connecting artificial intelligence to MIS

No matter which method is employed to develop an AI-based application, once it is completed a problem remains. "You still have to attach it," says Esther Dyson, publisher of the "Release 1.0" newsletter. "Half the problem is communications protocols and data base access. You need communication links," she says.

"We're getting more and more into tying into other data bases," says Frank Bordelon, manager of AI at Westinghouse Electric Corp.'s Power Systems Business group in Pittsburgh. "We need Prolog with hooks into other languages, like C, to call in data from other files and applications," he says. He says he still encounters medium-size problems in writing hooks from the Prolog programs to the data in MIS but that the job is getting easier with experience.

Herbert Schorr, who heads up IBM's AI program, emphasizes the integration of data bases and knowledge bases to move AI into the corporate mainstream. Access to corporate data bases through AI-based applications enhances the value of a company's information and makes it more accessible to executives lacking computing skills. Bordelon's experience underscores this idea.

"Our best applications are when we add AI to an ordinary program. It's a direction we're heading in," he said. Finding an ordinary MIS program and adding AI to it can also help to achieve things they couldn't do before, Bordelon adds.

He cited an application now in production that has saved the company approximately $10 million a year, an expert system used for process optimization in one of the company's manufacturing plants. Bordelon says that although different human experts exist for each section of the manufacturing process, no one expert had a grasp on the complete process.

Using an inductive learning methodology, which consists of inserting examples into a program that automatically generates rules, the areas of expertise were incorporated into one expert system, optimizing all the stages of manufacturing. "We developed insights that certain parameters were important to the process that we didn't realize before," Bordelon says. He has found the inductive learning programs to be faster than using knowledge engineers to observe and interview the human experts and then codify the gathered knowledge.

— EDDY GOLDBERG

AE (Application Expert), a recently announced [CW, Sept. 1] shell for embedding expert systems in Cobol applications.

John B. Landry, chairman of Distribution Management Systems, Inc., the Lexington, Mass.-based vendor of Impact/AE, says the product is designed to be embedded in a mainframe application, allowing the knowledge of a human expert to be drawn upon when needed.

The shell's inference engine can be called by a Cobol application to act on the rules in a knowledge base created by the user. It will sell for

> *'As the prices for machines continue to drop, the tools are staying expensive. Knowledge is expensive.'*
>
> — Patrick Harrison
> Computer Science Department
> U.S. Naval Academy

$55,000 to $125,000.

Some other companies offering AI products aimed at mainstream computing include Artificial Intelligence Corp., the Carnegie Group, Franz, Inc., Gold Hill Computers, Inc., IBM, Inference and Teknowledge, Inc.

Westinghouse Electric Corp.'s Power Systems Business Group in Pittsburgh has worked on approximately two dozen AI projects since 1983, about one-third of them involving expert systems, according to Frank Bordelon, manager of artificial intelligence.

Sixty percent of the applications are written directly in Prolog on an IBM Personal Computer AT, with 20% of them written in LISP and the remaining 20% being divided among Fortran, C and other programming languages.

AI work done on PCs

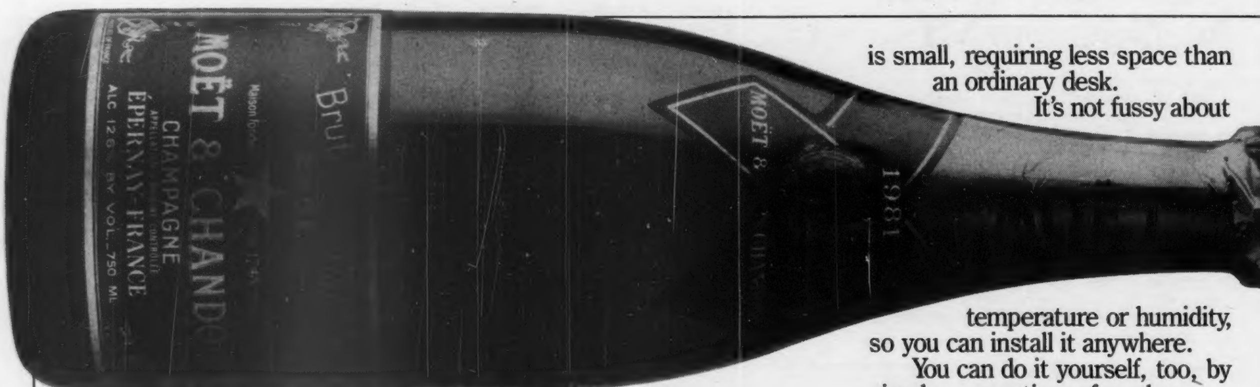
Although the company has symbolic processing machines in-house, he says they are not being used. Most of the AI work is done on personal computers using relatively inexpensive software.

He warns users considering embarking on AI projects that they "can spend a lot of money and not gain a lot."

In a recent study of 125 expert

Continued on page 218

Why the new Midframe comp



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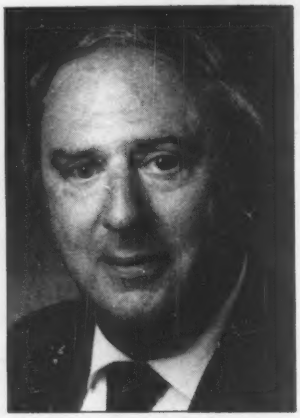

'It's important to make this technology available in the operational environments that exist today.'

Harry C. Reinstein
Aion Corp.

Continued from page 215

systems, 51% were built directly, using a general-purpose programming language, 38% used an expert system shell for development, 6% employed a consultant and 5% purchased off-the-shelf packages.

Resources for in-house development

Peter M. O'Farrell, who authored the study for Cutter Information Corp. of Arlington, Mass., noted that nearly all of those who purchased systems would have preferred to develop their systems in-house but lacked the technical resources.

When the respondents were asked about their plans for future expert system development, 43% planned to build directly, using a general purpose programming language, 33% said they would rely on a shell and build directly, 19% said they would use a shell alone and 5% of the respondents said they planned to use other methods.

Artificial intelligence also offers MIS other benefits. "The real value of AI is that applications are easier to build and maintain," says Esther Dyson, publisher of the "Release 1.0" newsletter.

"Rather than rewrite the system, change a rule, and the system restructures itself," she says.

Bordelon says the rapid prototyping possible with Prolog and LISP allows the development of programs that simulate all the capabilities of a final program.

"Instead of a lot of work on paper, we can simulate a program within a few days, how it works and what the screens look like." ■

Teaching AI's benefits

At Westinghouse Electric Corp.'s Power Systems Business group in Pittsburgh, Frank Bordelon, manager of artificial intelligence, says his biggest problem is educating his customers, both inside and outside Westinghouse, about the benefits to be gained from AI-based applications. He says half his AI work is educational. "People don't understand the product and have difficulty in seeing its value," he says.

This will remain a major hurdle for AI in the commercial marketplace until users are convinced it can offer solutions to commercial problems — and can run on their existing hardware with their current software. Many AI vendors are starting to offer courses to court corporate users.

In October, IBM opened a national center in the Cambridge, Mass., "AI Alley," to serve as a learning and support center for customers of its expert system building tools. A sister center is planned by year end near Silicon Valley's AI companies and Stanford University. Still, much progress must be made before AI technology is considered just one more part of mainstream corporate data processing.

One reason is that AI technology is very different from traditional programming technology, and something is lost in attempting to fit AI into the parameters of traditional programming, says Bruce Johnson, partner-in-charge, Artificial Intelligence Practices at Arthur Andersen & Co. in Chicago. "I encounter a lot of problems with people who want to take AI into the traditional environments," Johnson says. "We can train new people to think in AI terms more easily than retraining traditional systems programmers."

He takes issue with traditional programmers trying to translate AI thinking into what they know. "A rule set is not a decision tree; a knowledge base is not a knowledge *data* base," he says.

— EDDY GOLDBERG

How companies implement aritifical intelligence projects

Bruce Johnson, partner-in-charge, Artificial Intelligence Practices at Arthur Andersen & Co. in Chicago, says his group has consulted on many AI technology projects and they fall into six major groups:

1. Self-contained expert systems or advisers.
2. Financial analysis systems.
3. Configurator systems for part and component design, modular product lines and the process and chemical industry.
4. Diagnostic systems for tracking and repairing hardware, software and biological systems.
5. Planning and scheduling systems.
6. Unstructured information processing in which the system designer has no control over how the information arrives. Software engineering systems was on the list as a separate category.

AI appears to open the door to the use of judgment calls and weighted reasoning in business applications rather than the straight number counting and quantifiable logic of today's data processing. Nevertheless, Johnson says, AI is not going to replace traditional transaction processing, data base management and high-volume, relatively simple data processing.

AI in transition

He says AI is in transition and is still a technology looking for a solution in many companies, where it is being experimented with by those eager to learn more about it.

However, Paul Harmon, editor of the San Francisco-based "Expert Systems Strategies" newsletter, says it's not so much a case of AI needing problems to solve as a question of how corporations can take advantage of the opportunities it offers.

He says expert systems are just now beginning to appear on mainframes, although most of today's work is done on personal computers. Harmon cited the approach taken at one company in which the focus is on developing and running many small systems on PCs and distributing them throughout the corporation's approximately 70 business units. Total project costs are in the $25,000 to $50,000 range per expert system with reports of an 85% to 90% success rate, he says.

Expert system tools will have to run on both PCs and mainframes to be successful, and prices will fall dramatically as competition heats up, he says. He sees the market today in a transition from selling AI technology and software into research and development departments to more purchases being made by corporate MIS.

"MIS/DP shops will soon have a wealth of AI resources to draw on," says Tom Schwartz, president of TSA, a Mountain View, Calif.-based consulting firm. "The motivation is pure productivity," both for the end-users and for MIS. He said expert systems technology will allow MIS to make nonprocedural techniques available to end-users, freeing MIS for other tasks.

An AI application such as continuous speech, connected to an expert system shell, will allow end users unfamiliar with computers to directly perform data base queries and structure reports without involving MIS. This will reduce the applications backlog, Schwartz says.

"Over the years, as more and more expert system technology becomes available and integrated into existing MIS departments, you will find an enfranchisement of the end users to build their own applications," he says. "At the same time, the focus of MIS/DP will be moving away from application development into quality assurance and security functions, though MIS will still work on larger expert system development."

— EDDY GOLDBERG

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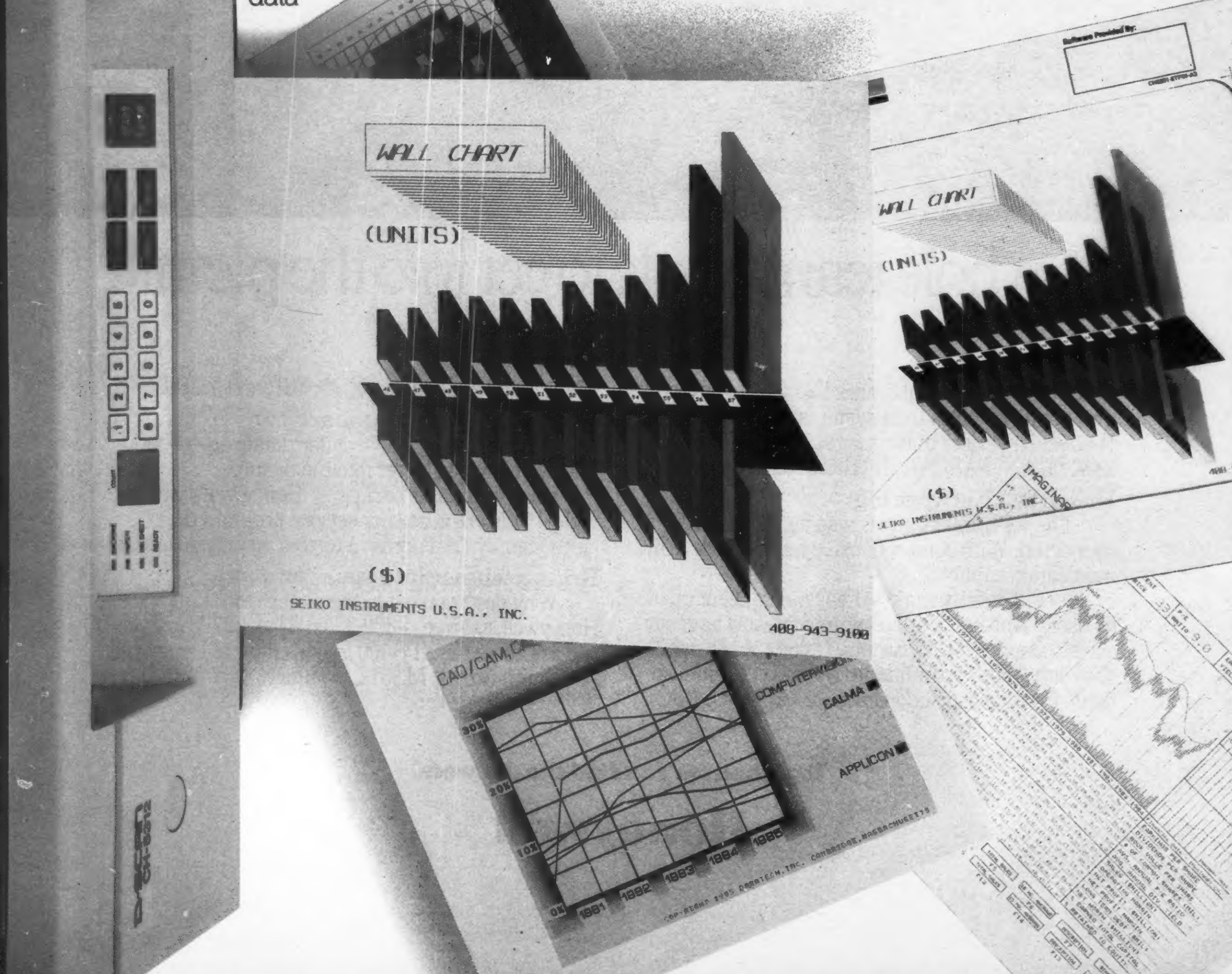

Industry drives ahead on Blue cycles

ILLUSTRATION BY MARK STEELE

By CLINTON WILDER

The rapid advances in microprocessor technology in the last 10 years have changed the shape of the computer industry in ways none of its original players could have foreseen.

While the business of selling computers has been through numerous economic cycles, consolidations and shakeouts during the past three decades, the industry in 1986 faces more market-driven challenges than ever before.

No vendor feels that more than industry leader IBM. With its key profit-making segment, mainframes, caught in a buying slump and its mid-range systems beset by confusion and incompatible architectures, Big Blue is working feverishly to shore up its once-indomitable market position.

The headlines of 1986, predicting a second straight IBM yearly earnings drop for the first time since the the Depression, would seem to be unthinkable in the computer age.

IBM will meet the challenge

But IBM has overcome challenges before, including entering an industry once dominated, if not monopolized, by Remington Rand, Inc.

> ***It's human nature to say, 'People made mistakes, but we'll succeed.'***

Remington Rand's Univac 1 machine arrived in 1950, both sooner and technologically better than IBM's first computers of the early 1950s. Remington Rand won what could be called the first commercial account, an order for two Univacs at the U.S. Bureau of the Census, in 1951. But like countless other vendors that would beat IBM to the punch in new markets during the next 35 years, Remington Rand became the first computer industry victim of IBM's awesome market power.

"From the minute the Census Bureau put in the first Univac, our drive was totally commercial," former IBM President Thomas J. Watson Jr. said in a 1983 interview with *Computerworld*. "I always managed through being terribly afraid of failure. . . . I was absolutely panicked."

Watson and IBM translated that panic into a commitment to research and development that continues today, when IBM's mind-boggling $5 billion annual R&D budget is the envy of the industry. Watson increased IBM's annual R&D spending of the early 1950s from 4% of revenue to 10%, an investment that paid off handsomely.

By 1956, according to Katharine Davis Fishman's 1981 industry history, *The Computer Establishment*, IBM held a U.S. computer market share of 85% to Sperry Rand, Inc.'s 10%. While the terms "Univac" and "computer" were synonymous to many laymen, some of those same laymen believed Univacs were built by IBM.

"They simply out-hustled Univac in a marketing sense," says Bob Djurdjevic, an industry analyst who left Big Blue in 1978 to found Annex Research, a Phoenix-based firm that tracks IBM and the plug-compatible vendors. "Marketing technology won the day."

Installed base critical

Technology has come a long way from the Univac and the IBM System 360 to the Sierra and the Digital Equipment Corp. Microvax of today, but the importance of a vendor's installed base is still the critical factor

"I need to reach both the MIS/DP *and* data comm manager. With Computerworld, I do."

Sharon Paster
Advertising Manager
Codex Corporation

Sharon Paster is Advertising Manager for Codex Corporation, a wholly-owned subsidiary of Motorola, Inc. As a supplier of integrated network systems for use in large corporations, Codex markets a broad range of products, including modems, multiplexers, communications processors, network management systems, and local area networks.

To increase company awareness and establish preference for Codex products, Sharon has chosen Computerworld as a primary advertising vehicle. The reason? Circulation and readership.

Sharon recognizes the important roles played by the MIS/DP manager and the data communications manager in large-volume purchasing of Codex products. *"Our primary customer is the data communications manager. But that person often reports to the MIS/DP manager, whose influence in the purchasing of data communications has been increasing over the last few years,"* she explains.

"Many times both the MIS/DP manager and the data communications manager are involved in the purchasing process. Sometimes, depending on the company size, it's either one or the other," notes Sharon. *"So I need to reach both the MIS/DP and data comm manager. And, with Computerworld, I do."*

As for readership, Sharon has conducted studies over Codex's customer base and found Computerworld to be extremely well accepted. *"Of our customers who are responsible for both data processing and data communications, Computerworld is the best-read publication,"* claims Sharon. *"And, for those customers who are responsible for only data communications, Computerworld is the first publication they look to after the leading data communications publication."*

Further proof of Computerworld's credibility is the high response rate to the Codex 800 number in its ads. *"The responses bear out all my research,"* says Sharon. *"Computerworld tops both its MIS/DP competition and the data communications publications as far as quality and quantity is concerned. Computerworld generates the largest number of high quality phone leads from large-volume buyers. And that's exactly what Codex is after,"* she concludes.

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for industry success.

In a sense, the industry has come full circle, notes veteran industry analyst William Easterbrook of Kidder, Peabody & Co. In the early days when a vendor's customers and even its salesmen did not fully understand the new technology, marketing savvy and getting close to the customer were the key elements in driving sales. In 1986, the industry players' favorite buzzword is that they sell solutions, not technology.

If the shape of today's mainframe computer industry can be traced back to a single point in time, many industry veterans believe that seminal event occurred in April 1964. On a day that introduced the concept of big-splash product announcements as well as a significant new approach to the business, IBM unveiled its System 360 product line in 200 movie theaters across the nation.

Although various technological glitches in the 360 line would delay its immediate impact, IBM's landmark announcement represented the first entire product line offering system-to-system compatibility and migration, and IBM's first and perhaps boldest move to strike fear, uncertainty and doubt in the hearts of its competitors.

Charles T. Casale remembers it well. As a project manager for one of those competitors, Control Data Corp., Casale recalls that Big Blue actually used trumpets in some of the theaters to add to the drama.

"The intent was accomplished: to absolutely intimidate the competitors," says Casale, now executive director of financial services for Boston research firm The Yankee Group. "Once IBM unified the product line, it was no longer possible to compete on an individual system basis. You had to be able to deliver everything and be at least a billion-dollar company. By 1965, the market shares solidified and they really haven't changed much since," Casale says.

Some observers believe the industry's history is primarily a tale of vendors building walls around their user bases with bundled software, proprietary architectures and, in IBM's case, covert and overt monopolistic practices.

"The vendors have abused their customers systematically for 35 years, in my opinion," says Gartner Group, Inc. cofounder David Stein. Stein, currently a partner in the Los Angeles venture capital firm of Julian, Cole and Stein, is also a veteran of CDC, Sperry Corp. and IBM.

"The big lever the vendors have always had is the software lock-in, and they have not done for the customers what they might have in a truly competitive situation," he adds. "The customers won't get that until there are true standards for portability between systems. But the customers are growing up; they won't just do IBM's bidding. And IBM is at least giving lip service to the portability issue."

With both market growth and U.S. capital spending currently stalled, the industry continues to claim its victims through consolidation, merger, acquisition and divestment. Before 1986 ends, one BUNCH company, Sperry, will have lost its corporate autonomy and Honeywell, Inc. may relinquish control of its computer business to overseas part-

"

Some believe the industry's history is a tale of vendors building walls around their user bases with bundled software, proprietary architectures and covert and overt monopolistic practices.

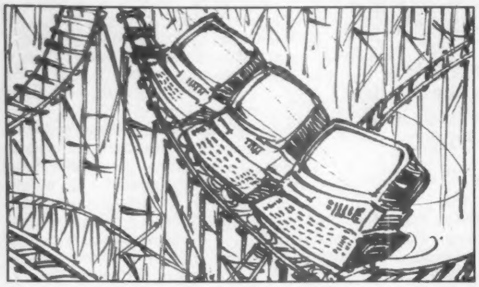
ners Groupe Bull and NEC Corp.

While the U.S. corporate landscape of the 1980s is dotted with companies such as Citicorp, Hospital Corp. of America and Weyerhaeuser Co. clamoring to make inroads in the information services business, the legacy of the 1960s and 1970s is full of corporate giants that failed dismally in selling computer hardware. General Electric Co., RCA Corp., Exxon Corp., Raytheon Co., Westinghouse Electric Corp., Bendix Corp. and Philco Corp. were all examples of highly successful corporations that stumbled in a turbulent industry.

"The industry's failures are as interesting as its successes," says *Computer Establishment*'s Fishman. "There is a general optimism and excitement about technology that is very engaging, but often there's a tendency to get carried away with what technology can do and how it can sell. It seems to be human nature in this business to say, 'People made mistakes in the past, but we'll do it differently and succeed.'"

Companies that have succeeded in a big way, like DEC and, for a time, Wang Laboratories, Inc., have done so by exploiting markets in which IBM was weak, or defining new markets before IBM did. Many believe the industry's cycles can be traced to IBM's own product and business cycles, many of which followed the ebb and flow of some 30 years of antitrust litigation against Big Blue.

"Many of IBM's business plans grew out of action in the courtroom, not the boardroom," says Annex Research's Djurdjevic. "The formation of IBM's General Business group with



the System 34/36 product line and the Data Processing division with the 370 architecture in the 1970s came about because the company fully expected to lose the government's antitrust case and be broken up like AT&T eventually was."

A related force that has driven the industry, particularly entrepreneurship and innovation within it, is the cycle of how IBM is perceived: either completely invincible, or vulnerable in parts of its business. "That perception, however, often depended on whether you believe the glass is half empty or half full," Fishman says.

The current perception is certainly one of IBM vulnerability, with Big Blue facing a second straight yearly drop in profits for the first time since the 1930s. In the past two years, IBM has been barraged by the overall slowdown in mainframe sales, tough competition from a revitalized DEC in the mid-range and the onslaught of low-priced IBM-compatible microcomputers.

The perception has been seen before. "Right before the 360 introduction in 1964, IBM was believed to be lagging behind the latest technology in disk drives, tape drives and magnetic memories," the Yankee Group's Casale recalls. "Other vendors thought that IBM might have been over the hill, but the 360 changed that perception quickly."

In trying to gauge the industry's future by looking at its past, only the most iconoclastic observers believe IBM will stay down for long. On two consecutive days last month, for example, Big Blue announced an agreement with Intel Corp. that hinted at potential proprietary microprocessor design, and a series of mid-range "VAX killer" products.

> ***'When you recognize that IBM is becoming revenue-starved, that's like loosing a hungry caged animal upon the world.'***
>
> **Francis Saldutti**
> **Gartner Securities, Inc.**

"When you recognize that IBM, after seven years of unprecedented growth, expansion and capital investment, is becoming revenue-starved, that's like loosing a hungry caged animal upon the world," says Francis Saldutti, vice-president and director of research at Gartner Securities, Inc. and a former analyst with Hambrecht & Quist, Inc. and Cowen & Co.

"IBM is becoming much more aggressive in software and software pricing, for example, than anyone expected," Saldutti adds. "It will leave no area untapped."

As the industry heads toward 1990 and beyond, it has become increasingly clear that its driving forces are primarily economics and market dynamics, not technology. While the latest developments in very large scale integration, parallel processing or artificial intelligence might be exciting, it is the hard numbers of installed base statistics and profit margins that fuel the industry's direction.

"We have reached a critical maturation point in the industry," says Saldutti. "We went through a period when companies began to rely on technology to solve every ill in management. That phase peaked in 1983 and 1984 and won't be seen again." ■

Mavericks and veterans: Evolving, thriving with the industry

By ALAN ALPER

Over the last three decades, two types of individuals have become almost synonymous with the evolution of the computer industry: the maverick entrepreneur and the seasoned veteran. Both Ted Smith, chief executive officer of Filenet Corp. and Paul Ely, chairman and CEO of Convergent Technologies, Inc. exemplify that trend to the hilt.

Smith has played both roles over his computer industry career as president of MAI Basic Four, Inc. and as founder of Filenet, a 5-year-old supplier of document storage and retrieval systems that use optical disk technology. Ely was responsible for transforming Hewlett-Packard Co. into a leading supplier of computers. Early last year he took the reins at Convergent, a fast growing start-up. Entrepreneurs and seasoned veterans come and go. Few, however, have the longevity — and persistence — of Smith and Ely.

Ely at Convergent helm

It's not easy inheriting a high-flying company that has returned to earth. But Paul C. Ely Jr., who succeeded Convergent Technologies, Inc. founder Allen Michels in January, 1985 as chief executive officer, has adjusted well to the situation.

Ely, 53, joined Convergent after 22 years at Hewlett-Packard Co. helping to build that company's computer operations from the ground up to a leading force in the industry. When he took the helm at Convergent, rumors were rampant that despite the company's heady growth during the previous few years, the Convergent was on the brink of bankruptcy. "When I arrrived, I found a company that had grown so fast in the prior two years that it had outgrown its infrastructure," Ely recalls. .

Solving such problems, Ely says, was easy. It became a classic case of invoking the basic tenets of asset management: clamping down on creditors and taking a leaner posture on inventory and other expenditures. Ely guided the cash-poor company into a position where, as analysts claim, it now has almost $75 million in cash, even after a flurry of acquisition activity.

> *'I'm attracted to life in the fast lane. Convergent is filled with people who are impatient about getting things done quickly.'*
>
> — Paul C. Ely
> Convergent Technologies

But Convergent is not out of the woods yet. The company's Achilles' heel has been sales and marketing. Under the previous regime, Convergent attempted to build a coterie of OEM accounts. That strategy worked as long as demand from firms such as AT&T and Burroughs Corp. remained strong. Yet once demand diminished, Ely had to come up with a new approach. Under his command, the firm has repaired relationships with its OEM customers and has broken out a new operating unit, Convergent Business Services, which markets Convergent's products directly to specific vertical markets.

Ely knows from his years of experience at Hewlett-Packard that instilling a stronger marketing and sales sense at a technology-driven company is not an easy task. He joined HP in 1962 after a nine-year stint with Sperry Rand Corp. In the late 1960s, he became division manager of HP's first computer project. Ely is considered the force behind HP's hugely successful 3000 family of minicomputers, which enabled the scientific instruments maker to establish inroads in the data processing industry. His ascension at HP paralleled the firm's meteoric rise in the computer industry.

Yet it wasn't easy, Ely says. "HP had to learn how to sell in what was a dramatically different market — the MIS world. It had to compete with the best marketing company in the world — IBM."

Now, he is in the midst of a very different image-changing process at a much younger company. "I'm attracted to life in the fast lane," he declares. "Convergent is filled with people who are impatient about getting things done quickly. At some places that wouldn't work, but it is a positive thing here." Many contend that Ely is one of the few Silicon Valley executives who could have

Continued on page 230

Smith nurtures his brainchild

In 1982 the IBM Personal Computer established itself as the de facto microcomputer standard. It was also the year a new company named Filenet Corp. began its quest to develop technology to make "the paperless office" a reality.

Filenet is the brainchild of Ted Smith, 57, an 18-year industry veteran. In 1975, the Washington, D.C., native was wooed to Southern California to take the helm of MSI Basic Four, Inc., the then minicomputer subsidiary of the now defunct Management Assistance, Inc. (MAI). Under his guidance, Basic Four grew from a $40 million to $220 million firm in 1981 with over 20,000 customers worldwide.

Smith left Basic Four in July 1981 over a policy dispute three years before MAI sold the firm to a group of investors. Smith set out to set up his own firm where he wouldn't have to answer to executives of a parent company 3,000 miles away.

In early 1982, while other entrepreneurs formed companies to capitalize on the then-raging microcomputer craze, Smith had loftier goals. His vision centered on designing computer workstations to automate the storage and retrieval of documents in the office. Smith ventured into uncharted technological territory, developing systems that used high-density optical storage devices and networking software to control the flow of documents throughout an office, department or corporation.

"The PC business would have been an easier thing to get into, but the document image processing systems business looked like it someday would be a larger market," Smith recalls.

Smith set out to gather evidence to convince potential investors of the merit of his vision. Amassing a mountain of data, Smith had little resistance raising $4 million to get the company off the ground. That funding carried the firm through its first two years of product development.

> *'PCs would have been an easier thing to get into, but the document image processing systems business looked like it someday would be a larger market.'*
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> — Ted Smith
> Filenet Corp.

"Ted put a lot of effort into the analysis of the market and the technology, so he didn't have much difficulty getting funding," says Brad Jones, a partner at Brentwood & Associates of Los Angeles, a venture capital firm that has participated in Filenet's three rounds of financing to date. "Ted is also especially well known in the industry; he's personally competent and surrounded himself with a good team of people."

Smith attributes his ability to start his own company on his industry reputation, experience and connections. He entered the industry in 1968 as executive vice-president of Sycor, Inc., an Ann Arbor, Mich., start-up that did pioneering work in distributed processing systems and intelligent terminals. Smith contributed to building the fledgling company to a profitable $54 million firm.

After his stint at Basic Four, from 1982 through 1984 Smith quietly built sturdy foundations so Filenet could withstand the pressures of unveiling its new concepts of of-

Continued on page 230

Regional holding companies target Fortune 500 info market

By MITCH BETTS

The merits of the government's 1982 decision to break up AT&T can be debated ad nauseam. But there is no dispute that divestiture catapulted seven aggressive new vendors, the seven regional holding companies, into the competitive fray of the information age.

Although each of the seven regional holding companies — Nynex Corp., Bell Atlantic Corp., Bell South Corp., Ameritech, Southwestern Bell Corp., U.S. West and Pacific Telesis Group — has a distinct business personality, analysts point to one thing they have in common.

They all are desperate to keep businesses and other large users on the local switched telephone network and eager to penetrate the Fortune 500 business market for integrated computer and communications systems [CW, March 17].

Well-educated sales force

"They're putting a well-educated salesman at the door of every large customer," says Fred Chanowski, president of Telecommunications Management Corp., a Needham, Mass.-based consulting firm for large end users and vendors.

The sales force is offering big businesses a varied menu that includes enhanced Centrex services, private branch exchanges (PBX), local packet-switching services, metropolitan-area networks and even, if pressed, dedicated fiber-optic lines that bypass the local loop.

However, the regionals' ambition to become comprehensive telecommunications providers has been hindered by Federal Communications Commission regulations that dictate that customer premise equipment (CPE), as well as enhanced telecommunications services, must be offered by subsidiaries that are kept separate from the 22 divested Bell operating companies' regulated telephone businesses.

For example, Bell Atlantic can act as a prime contractor to package the services of its telephone subsidiaries with the CPE of other vendors, but can only make neutral referrals to its own CPE subsidiary because of regulatory constraints, says Julie Dobson, another Bell Atlantic marketing manager.

All of the holding companies have lobbied vigorously in Washington, D.C., for removal of the FCC rules requiring arm's length separation between the network and CPE subsidiaries.

In the meantime, the holding com-

Continued from page 228

succeeded Michels.

While he is considered to be not as abrasive or as domineering as his predecessor, Ely is said to be a hands-on CEO who very often takes a confrontational stance with middle management.

Analysts give Ely high marks. "He's tried as best he could to put the company into a mode so it could be a forward-going business and has achieved his main goals," says James Magid, an analyst with L. F. Rothschild, Unterberg Towbin in New York.

Ely is now turning his attention from short-term problems to long-term challenges. "I don't feel the glory days of the industry are gone," Ely muses. "There'll be substantial growth, but it's not over the horizon. It'll take a couple of years, but it will happen."

Ely, however, refuses to be pinned down on a projection. "The likelihood of any one of us predicting what will happen in the next three years is not good," Ely laughs. "If you want to know what won't happen, listen to the projections." ■

Continued from page 228

fice automation to an untapped market.

By early 1984, its product development complete, Filenet unveiled its technology.

Filenet's technological approach consists of using an optical scanner to digitize documents and images, which are then stored on write-once optical disks.

The system is aimed at financial institutions, insurance companies, industrial firms and government agencies.

It is already installed in 35 "paper-intensive" organizations, including Citicorp, the government offices in New Jersey, Home Savings of America and Merrill Lynch, Pierce, Fenner and Smith.

In a moment of reflection, Smith concedes that Filenet could be the final stop in his corporate career. The company, which has raised $39 million and retains $25 million in cash assets, is hoping to go public during the first half of next year, market conditions permitting. Smith says he would like to stay on to enjoy the fruits of his labor.

"This is it. I don't want to start a business again. I want to run this company and expand it to be an important entity in the industry." ■

panies are stretching the existing regulatory contraints as far as possible to offer something close to full integration.

Nynex Business Information Systems Co., for example, obtained a waiver from FCC rules so it can act as a marketing agent for Nynex telephone company services along with CPE, but it cannot share customer information freely between the subsidiaries.

Meet FCC conditions

Further, it must meet other conditions imposed by the FCC, according to Pete Goodale, a Nynex spokesman.

"Clearly, we'd like to have full integration so that our account executives can go to businesses with the information they need to make the best pitch to the client," Goodale acknowledges.

Independent telephone companies do not come under the separate subsidiary ruling because they were never a part of the Bell system.

Rochester Telephone Corp. has made good use of this freedom by offering a full line of telecommunications offerings under the same sales, service and support umbrella.

"I can sit with them and talk with them about hardware, PBXs, maintenance contracts, upgrades, tie-lines and T1 multiplexers as a single proposal," says Joseph Fornieri, manager of Com-Net Systems for Chase Lincoln First Bank N.A. in Rochester, N.Y.

Kevin Shannon

Some business customers say they wish the regional holding companies would devote less of their attention to expanding their product lines and devote more of their attention to the quality of support that they provide for existing telecommunications services.

Kevin Shannon, who is the manager of telecommunications for General Electric Corp. operations in Syracuse, N.Y., complains that since divestiture, "whenever there is a problem, particularly with four-wire circuits, we end up having to deal directly with the exchange carrier and directly with the local operating company."

Good statistics needed

Customers who expect their carriers to do the problem solving for their networks — especially for hybrid networks that incorporate several different vendors' services as well as equipment — "had better provide good statistics" about where the problem is located, General Electric's Shannon adds.

"It's too easy for carriers to fingerpoint."

On the other hand, many of the regional holding companies are expanding their service and equipment lines as part of their campaign to keep large business customers, Chanowski says.

The companies that are responding to business requests for proposals with bids to supply either Centrex-based services or customer premise equipment, whichever one the business wants, he adds. ■

> *'I can sit with them and talk with them about hardware, PBXs, maintenance contracts, upgrades, tie-lines and T1 multiplexers as a single proposal.'*
>
> Joseph Fornieri
> Chase Lincoln First Bank N.A.

The telecom services front

The divested Bell operating companies have been highly successful in curtailing the loss of large Centrex Service customers, observers agree.

By converting their central offices from analog to digital and offering a variety of enhancements like central office-based local nets, the Bell operating firms are retaining big users who otherwise would turn to digital private branch exchanges, says Mark Winther, communications analyst for Link Resources Corp. in New York.

A growing number of Bell operating companies have filed tariffs to offer a local packet-switching service, but it is too early to tell if that will be successful, says Richard Kuehn, president of RAK Associates, a telecommunications consulting firm in Cleveland.

"My guess is that it will be more successful in the long run," Kuehn says. "I suspect that local leased-channel rates will go up, which will force the data users over to the packets. Ultimately it will be structured like the long-distance

Continued on page 235

> ***'It's evident that ISDN will be more readily introduced through digital central offices — that's where all the ISDN trials are happening — rather than through the PBX world.'***
>
> **Fred Chanowski**
> **Telecommunications Management Corp.**

voice industry, with the Bell operating companies as local carriers of data by packet, delivering it to others for long-haul transmissions," he says.

But Robert Ellis, president of The Aries Group, Inc., a Rockville, Md.-based consulting firm specializing in large voice and data networks, says the local packet services have little appeal to users who have nationwide operations, because they would have to arrange for long-distance transmission.

"Since the Bell operating companies are limited to distribution within local service territories that don't encompass a significant portion of most large users' communications needs, they are at a serious marketing disadvantage," Ellis says. Consequently, the services are more attractive for regional users like state and local governments and banks, he says.

One issue that has been debated before the Federal Communications Commission since divestiture is whether the regionals — and AT&T as well — should be allowed to offer protocol conversion as an adjunct to packet-switching services.

The divested carriers currently can offer packet-switching as a regulated tariff and have successfully petitioned for some types of protocol conversion — asynchronous to X.25, for example — to be offered as part of those services. They argue that many types of protocol conversion are necessary components of packet switching and should be treated as part of the service.

Waiting for ISDN

Some analysts believe the regional companies and AT&T are holding the promise of the Integrated Services Digital Network (ISDN) to keep users from moving from their Centrex services to customer premise equipment and private lines. "What's keeping users interested in Centrex is ISDN," says Fred Chanowski, president of Telecommunications Management Corp. ISDN has been positioned as a standard for voice, data and video communications.

"It's evident that ISDN will be more readily introduced through digital central offices — that's where all the ISDN trials are happening — rather than through the PBX world," he says.

An additional motivation for the regional companies to push ISDN is that their customer premises equipment (CPE) subsidiaries have so far done poorly compared with the regulated services arm. "In fact, I think they'll pull out of CPE sales in the next three to five years because it's such a commodity market," says Winther, the Link Resources analyst.

The regional telephone companies have had little success in penetrating the computer and office automation markets, according to Leon Jackson, manager of the office automation practice at Cambridge, Mass., consulting company Arthur D. Little, Inc. "When you ask MIS about the regional Bell holding companies, they still think of them as the local phone company. If you're trying to tell the world you're an office automation company, and the world sees you as a local telephone company, then you're not going to get past the front door in big businesses."

Chanowski is less critical, noting that the CPE subsidiaries have existed only a few years. "Give them some time. I think they've done an admirable job for 2½ years in the business," he says.

— By MITCH BETTS

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Researchers focus on promise of eye-gaze technology

By ALAN ALPER

In the 1977 science-fiction novel *Firefox*, the Soviet Union has developed a fighter plane that can fly six times the speed of sound — undetected by radar — and that has an integrated weapons system that can be operated by thought waves.

Sounds farfetched? Not really.

Today, in a number of small university and corporate labs, technology is under development that would enable a human being to control a computer, navigate an airplane or maneuver a robotic system by eye movement. While the focus, for the most part, has centered on how to make life easier for the physically handicapped or how to actually develop an aircraft that could be operated by gazing at flight instruments, work is being done to adapt this technology to a variety of other applications, including data processing.

While the keyboard, mouse and joystick will continue to be the primary ways to control a computer, many contend the human eye gaze will one day become an invaluable adjunct to these methods. Some believe research in eye-gaze technology could shed light on the ultimate control mechanism — the brain.

"We believe that eye gaze is just another avenue to increase the man/machine bandwidth," says Gary Kilikany, vice-president at Sentinent Systems Technology, a Pittsburgh start-up that recently unveiled a system that enables people who cannot communicate to do so by controlling a computer with their eyes.

"In some situations, there's nothing more natural than looking at something like a video screen to select menus or to push buttons," Kilikany says. "It's a very natural alternative to a man/machine input mechanism."

IBM scientists at the Thomas J. Watson Research Center in Yorktown Heights, N.Y., spent a good deal of time in 1981 researching eye gaze as a means of controlling a computer. IBM, which was recently awarded a patent for an eye-tracking mechanism, was attempting to develop a high-resolution display that could be controlled by eye movement.

"We never finished the project," recalls Jim Levine, a scientist on IBM's research staff, noting that the pre-IBM Personal Computer program used a Series/1 minicomputer, which would have made a commercial product extremely expensive to purchase. "We did build an eye tracker, however, that was accurate enough to control a computer."

While IBM dropped the project soon thereafter, the fruits of that labor are being enjoyed by researchers at the University of Virginia in Richmond, Levine says. "They are working on an eye-tracking system for the handicapped that they hope to soon build into a product," he remarks. "We've loaned them some PCs and are doing some consulting on the project."

Labs like the one at the University of Virginia and another in the Trace Research & Development Center on Communication, Control & Computer Access for Handicapped Individuals at the University of Wisconsin at Madison's Waisman Center continue to push the technology to its limit.

Perhaps the most ambitious research, however, is being done by a small defense contractor nestled in the hills of northeast Pennsylvania.

There, a 19-year-old privately held firm, Analytics, Inc. in Willow Grove, has spent the last 18 months developing eye-gaze technology, used in concert with existing voice-recognition systems, to control computers, robots and vehicles. The development work is being financed primarily by the National Aeronautics and Space Administration under the Small Business Innovative Research Program.

Visual attention, vocal intention

Called the ocular attention-sensing interface system (OASIS), the device measures an operator's visual attention and vocal intention.

"We are looking at the foveae — where a person sees — to get attention and are coupling that with speech recognition to get intention," notes Analytics' President Steve Leibholz. "It's the closest thing to automatic or unconscious control."

OASIS uses a technique in which light is projected into one eye, a portion of which is reflected by the cornea to create a virtual image that responds to changes in the relative position of the eyeball. Using a high-speed analog signal processor, OASIS is said to monitor movements of the eye of less than 1 degree of arc.

Also used is a Texas Instruments, Inc. voice-recognition system in which a series of single-word commands are stored.

Eye movement and voice data are sent to five algorithmic modules that analyze the eye movements and voice patterns, among other things, and translate them into system commands.

In current studies, a subject sits before a color monitor in a stationary

position, and an oculometer is fixed on his pupil and cornea to follow the eye's movement. The subject's voice commands are stored in the speech recognizer.

The subject is then asked to follow the movement of objects on the monitor and to invoke the command "fire" when the cursor becomes synchronized with the target. If the cursor is in synch when the command is given, the target is destroyed.

While NASA is most interested in the technology for its manned space flights and stations, Analytics contends the OASIS's applications are endless. The company has already come up with 25 applications, including aiding the handicapped, air traffic control, robotics and computer system management.

Under the computer heading, the firm lists data retrieval, computer-aided-design and manfacturing, photographic interpretation, signal processing, supercomputer process management and computer vision.

While viewed as an adjunct to other input and control methods, Leibholz foresees OASIS being used as an extremely fast and accurate way of searching through dense data bases for desired data. Some view it as an Evelyn Woods approach to computing.

"In our concept, an operator can pick one item out of 100 items that flash by on screen 100 times as fast as if doing it manually," Leibholz says. "It's a more sophisticated way of visual recognition."

It is the voice portion of OASIS that may prove to be difficult to adapt to commerical settings, he adds, noting the limited number of words such devices can recognize as well as the ambient noise as factors that cause inaccuracies.

Analytics must overcome other technological hurdles as well. Natural occurrences, such as blinking and eye drift, cause OASIS some eye-tracking problems. Also, in its current stage of development, corrective lenses and sudden head movements throw OASIS off.

"People have a tendency to move their eyes suddenly — it's a means of defense," IBM's Levine says. "Something like that is always there and is hard to overcome."

So far, under the NASA Small Business Innovative Research program, Analytics has received $550,000 to prove the feasibility of its concept, much of which has been spent acquiring equipment.

The firm is currently seeking additional funding to develop two engineering prototypes in 1987 that will be firmware and software driven and will use multiprocessor technology. Leibholz says the firm is looking for investors from the private sector but is also considering breaking out the OASIS project as a separate company via a public offering.

Meanwhile, Analytics hopes knowledge gleaned through development work on OASIS on how the brain analyzes information received from the eye will form the foundation for study of actual thought-controlled systems. Leibholz believes that by using a noncontact magneto-electroencephlograph to measure brain activity, inferences can be made about what a person is thinking.

"There's no reason why you can't get at what a person is thinking," Leibholz says, "I'm not prepared to go into detail, but there is potential feasibility using a magneto-electroencephlograph to achieve knowledge of attention of focus or some measure of control."

While development work at Analytics continues, Sentinent is already marketing a device that uses eye-gaze technology to enable physically impaired people to communicate.

The firm recently began shipping a cost-reduced version of its eye-tracking device — called Eyetyper — that is priced at $3,000 and can be connected to microcomputers through an RS-232 port. The 3-year-old company was founded by former Carnegie-Mellon University engineering students in Pittsburgh who were involved in a volunteer project to enable children with cerebral palsy communicate with their eyes.

So far, Eyetyper is mainly used in intensive care units, rehabilitation hospitals and special education school systems. Kilkany, however, sees many potential applications in the not-too-distant future for the technology.

"Right now, the system is used by people who can't speak or move their hands or legs easily," Kilkany says. "It's not sold to mainstream America — at least not yet. We do want to go in that direction.

"I can see it used in computing as a device that enables a user to select menus," he continues. "Or, in factories where a worker's hands are busy, and he needs to register defective parts and can do so by looking into an LED." ■

PHOTO COURTESY OF SARAH SMITH

Analytics' Steve Leiboltz

If the space program had advanced as fast as the computer industry, this might be the view from your office.

And space stations, Martian colonies, and interstellar probes might already be commonplace. Does that sound outlandish? Then bear these facts in mind:

In 1946 ENIAC was the scientific marvel of the day. This computer weighed 30 tons, stood two stories high, covered 15,000 square feet, and cost $486,840.22 in 1946 dollars. Today a $2,000 portable can add and subtract more than 20 times faster. And, by 1990, the average digital watch will have as much computing power as ENIAC.

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▶ Reader Commentary

Vendor airs and market doldrums

By SHELDON R. GAWISER

Every business publication seems to have blasted the computer industry recently. According to their articles, the computer industry is largely responsible for the current economic malaise.

Numerous reasons are cited: The industry needs to design easier to use systems; fit systems better to user needs; bring new technology more quickly to market. Even John Roach, chairman of Tandy Corp., was recently quoted in *The Wall Street Journal* as blaming part of the doldrums of the industry on lack of innovation.

One of the major arguments used against the industry is the number of idle computer systems, those purchased but never really used.

In most cases this argument concerns micros. (I have not yet seen any evidence of brand-new mainframes sitting idle because the company did not have any use for them.) But what is the root of this problem?

Introducing any new tool into the business environment is a management challenge that starts with the decision to purchase a tool and includes its selection and cost analysis.

If the results of the analysis justify the investment, the company will purchase the most appropriate machine from the most qualified vendor.

Suppose a company goes through such an analysis and decides to purchase an injection molding machine. Later management finds that the machine sits idle most of the time — maybe because of incorrect sales projections, maybe because the machine was simply a poor choice.

In either case, there was a bad management decision. Does the injection molding company and industry get blamed? Never.

Why then does the computer industry get blamed for idle computers? There are three basic reasons:

The computer industry is guilty of overselling. The computer is not the solution to every business problem. Instead, it is useful in some and useless in others.

Too many business people rely on the opinion of unqualified advisors when evaluating and purchasing computers.

> ***"The computer industry is guilty of overselling. The computer is not the solution to every business problem. Instead, it is useful in some and useless in others.***

The salesperson in a computer store has limited product knowledge, and his opinion is often based more on what is in stock than on what is best.

Moreover, neither the retail salesperson nor the direct salesperson for a computer manufacturer is likely to spend the time to learn enough about the business in question to make an informed judgment. This is one area where mainframe companies have the ability to spend considerably more time and effort.

Managers make mistakes. Too often they view the purchase of a personal computer as a trivial expenditure.

After all, how much time can you spend on a $3,000 to $5,000 purchase? However, the price of

Continued on page 241

Gawiser is president of Gawiser Associates, Inc., a Westport, Conn., consulting firm.

Videotex: Beyond the word

By MICHAEL A. CONNIFF

Once, videotex was the stuff of consumer marketing dreams, a word redolent of meaning, a magic carpet for the rainbow of services that would surely and swiftly computerize the American home. Electronic newspapers, home banking, home shopping, bill paying — even egg scrambling snuck into breathless descriptions of the technology's potential.

The English had their own word in the 1970s for the technology: "viewdata," for the pioneering Prestel system then stumbling into the consumer marketplace.

The Canadians had "telidon" technology subsidized by the government. Marketing arms of the French government came ashore with bewildering nominal inconsistency, calling their solution everything from "antiope" to "telematics" to "minitel."

This confusing name game and concomitant international standards' spats, threatened to sink videotex before the word ever reached *Webster's Dictionary*. Then what passed for sunlight flashed through the clouded North American scene.

At Videotex '81 in Toronto, AT&T, CBS, Inc., the French and the Canadians agreed on a new standard, soon to be tagged "North American Presentation Level Protocol Syntax" (NAPLPS), or nap-lips to the industry cognoscenti.

There was a brief and near-unanimous agreement that this graphics-rich standard, designed to stuff logos, colors and animation down a consumer's telephone line, was videotex.

Videotex thus meant pages or screens of information, accessible with a dumb terminal via easy-to-use menus, a data base that was adorned with pretty, cartoonesque NAPLPS graphics.

As news of the new protocols filtered south from Toronto to the U.S., it was assumed the oligopolistic power of AT&T and CBS would spell success for videotex in the home. Fortune 500 media companies like Time, Inc. and Times-Mirror Co. hastened to endorse what the Toronto conference had wrought. In this fashion, the word videotex came to mean consumer videotex: graphic services in the home.

Gradually, however, the first signs of semantic confusion appeared. In its own awkward way, the press was hyphenating and adding text to make sense of the contradictory concepts inherent in the words "video" and "text." The technology had little to do with either.

> ***"Videotex has little to do with video or television. Consumers turning to videotex as interactive television were in for swift and unsettling disillusionment.***

By attaching "video" to home information services, the word raised expectations that the net result had something to do with television.

Knight-Ridder Newspapers, Inc., Time and Times-Mirror (and, more recently, Covidea, the joint-venture between AT&T, Bank of America, Chemical Bank and Time) compounded the error by trying to market videotex services as an adjunct to the television set.

In fact, videotex has little to do with video or television. It

Continued on page 242

Conniff is a consultant and writer based in Burlington, Vt.

the computer could be a very small part of the cost of a bad decision. The risk of an idle PC may appear relatively small, but there is also lost time and effort of staff.

There can be far worse consequences if bills are not sent out on time, receivables not collected, inventory not reordered, discounts on payables not realized, or payroll not run.

The cost of automation mistakes can be many times the cost of the system. But this does not differ from the cost of other tools.

What should the user community expect the computer industry do to help reduce these problems? There are five principal steps:

First, **vendors should tone down the promises.** We ought to look carefully at the expectations raised by our advertising and promotion, including our claims regarding how easy it is to automate a company.

> ***While there may be a place for fear, uncertainty and doubt in telling your children not to talk with strangers, it really doesn't fit in selling computers.***

Second, **vendors should help to educate business people.** Let's make sure that business people recognize that they first need to know how their business really works manually in order to automate.

They must understand that (a) computers are important because they deal directly with the operations of the business; (b) no installation of an automated system will save time immediately — there must be time to train and run parallel systems; and (c) business people need to know what tasks they can perform profitably with their computers, particularly smaller ones.

Third, **vendors should not apologize for new technology.** While everyone knows a better, faster, cheaper alternative is just around the corner, no one will survive in this industry if we constantly sell futures. For most businesses, there is no real advantage in waiting for the next great technology change.

Fourth, **vendors should avoid selling by knocking their competitors.** While there may be a place for fear, uncertainty and doubt in telling your children not to talk with strangers, it really doesn't fit in selling computers.

Comparisons can be done in two ways: (a) showing the superiority of your solution; or (b) showing the inferiority of your competitor's solution. The customer gets a much better feeling from the former.

Fifth, **the computer industry ought to fight back.** Much of the problem is created by so-called industry analysts who need to find something to complain about. With the new tax laws in flux and capital spending by business down significantly, one would be extremely surprised to find the computer industry doing very well.

In addition, the phenomenal growth rates of some segments of the industry during the last five years are not really sustainable.

Why not have some of our industry leaders say positive things? We have accomplished more in increasing price/performance ratios than any other industry. We have provided tools to significantly increase the information processing capacity of all but the very smallest business.

We have allowed white-collar productivity to increase, however slightly, in spite of significant increases in governmental paperwork. We have managed to do all this in the face of very severe foreign competition without much governmental help.

It is time to take the offensive. Our conferences should not be on what is wrong with the industry, but on how to sell to business in a consultative manner; not on why sales are down, but on how to explain new technology to the uninitiated; not on why computers sit idle, but on how to train business people to make better buying decisions. ■

just happens that televisions make adequate monitors — barely adequate. But that's it.

Consumers who were turning to videotex as interactive television were in for swift and unsettling disillusionment.

Meanwhile, a funny thing happened in the marketplace. The first NAPLPS services — Knight-Ridder's Viewtron and Times-Mirror's Gateway — were launched with great fanfare and miniscule consumer response.

These services were slow, expensive and not particularly easy to use. They also required the costly dedicated AT&T Sceptre terminal, discounted from $900 to $600.

Using a personal computer in the home was not quite right, according to videotex purists who insisted, "That's not videotex." Videotex, by this definition, may have been slow, but it couldn't jump.

Circa 1984 and 1985, as the early disappointing returns dribbled in from south Florida and Southern California and it became clear almost no one had any interest in NAPLPS videotex services, the definition of videotex began to mysteriously expand.

It came to encompass ASCII text-only services like Readers Digest Association, Inc.'s The Source and Compuserve, Inc.'s Compuserve, fast-growing services accessible from almost any terminal.

It stretched beyond the computerized living room to services aimed at business. In order to remain a viable semantic entity, the term came to mean just about any information system that did not spit in the face of an unwashed end user.

By Videotex '86 this past May in Dallas — when purist NAPLPS consumer services had flopped ingloriously everywhere from Miami to Chicago to Los Angeles — videotex had grown to mean all things to all vendors.

Once Viewtron and Gateway shut down early this year, hewing to the narrow definition (consumers, graphics, dumb dedicated terminals) meant painting yourself into a NAPLPS corner and effectively disputing the lessons emanating from the real world.

Vendors like Digital Equipment Corp. stopped mentioning the word videotex to prospects.

Instead, they detailed the advantages of VAX VTX, their videotex software package, or they bundled VTX into All-In-1 office automation solutions aimed at functional areas within corporations.

In the same way, Honeywell, Inc. had taken to calling it electronic publishing or simply, Infonow, the brand name for their videotex software.

The culmination of this industry name game came during an open session that was called "What's Really Happening in Videotex" at Videotex '86. In one of the strangest exhibitions in the annals of new information technologies, nearly 200 industry loyalists spent the better part of 90 minutes exploring their identity crisis out loud.

From Canada, Australia, New Zealand, the UK and the U.S., these industry players came. Each had a different definition for this monster of verbal imprecision that haunted them still.

What was videotex? Boxed in by the purists, rejected by the marketplace, it was never really anything beyond easy on-line access for unskilled users to information, communications and transactions. As such, by any other name, it will be with us forever. Sadly, it was mistaken as a revolution, rather than an extension of time sharing and distributed communications developments that began decades ago.

So we are left with the bittersweet legacy of a word that never worked. It happens all the time. Office automation. Artificial intelligence. Desktop publishing. Words that confuse as much as enlighten. Words that are mere shadows of the ideas that drive them. ■

> ***Boxed in by the purists, rejected by the marketplace, videotex was never anything beyond on-line access for unskilled users to information, communications and transactions.It was mistaken as a revolution, rather than an extension of time sharing and distributed communications developments that began decades ago.***

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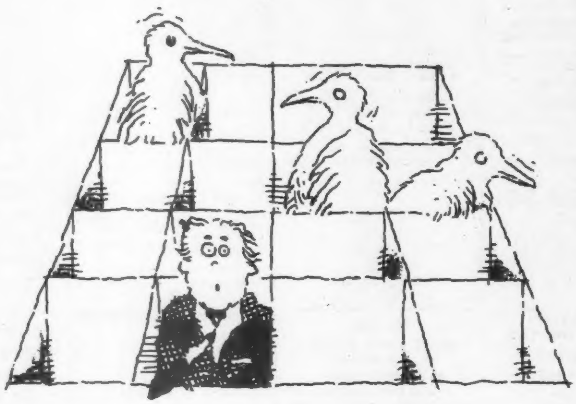

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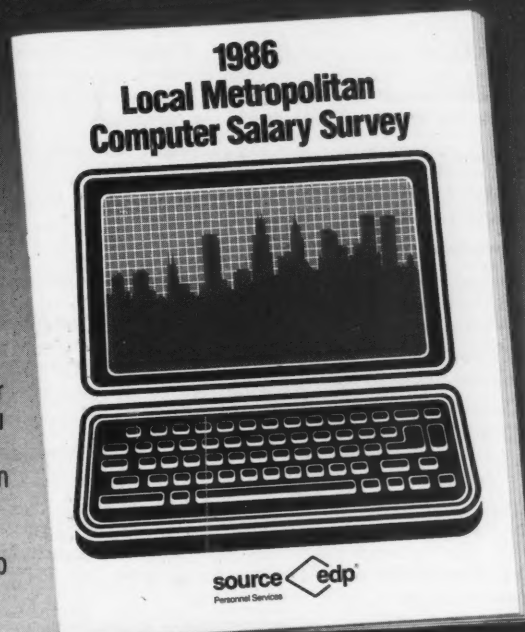

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Data Processing

Sales Support Representatives

Is your current position contributing to the revenue of your corporation?

At UCCEL, one of the nation's leading independent software vendors, data processing is our only business. Join our **Systems Software Division** as a **Sales Support Representative** and you can directly impact the revenues of our corporation.

You can join us in either our **Chicago**, **Dallas**, **New York**, or **Los Angeles** office and make a valuable impact in support of either our **MVS Systems Software** packages (UCC 1,3,7,11,4, and 8) or **SYNOVA** (software integration) product line.

You will be responsible for:

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- College degree in a related area.
- Strong communication and presentation skills.
- Solid background in systems and operations, preferably in a management capacity.

The positions supporting our **SYNOVA** product require 3 or more years systems programming experience in a large DP center, MVS experience in an IBM Mainframe environment and working knowledge of VTAM networks and gens, ISPF, TSO fundamentals and COBOL macro coding.

The positions supporting our **MVS Systems Software** products require 4+ years experience in an IBM Mainframe environment in systems technical support or production control. Experience with OS, MVS, XA as well as exposure to COBOL and ALC, a plus.

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UCCEL Tower
6303 Forest Park
P.O. Box 660054
Dallas, TX 75266
Attn: Sue Ratcliff

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PROGRAMMER/ANALYST - Design and redesign of computer systems from specifications. Analyze requirements, design and programming, documentation and testing in on-line manufacturing environment. Require Bachelor's in Computer Science or Math and 3 years experience including CICS, COBOL, manufacturing environment, OS/MVS, DOS/VSE, VM/CMS and programming design level participation. Full time 8-5. Salary $28,000 per annum. Job location - Detroit. Send resumes to 7310 Woodward Ave., Room 415, Detroit, MI 48202. Reference #64986. Employer Paid Ad.

SOFTWARE ENGINEER: Design & development of software systems encompassing vector, raster & pattern recognition disciplines and related interfaces to I/O & processor hardware. Develop computer-aided mapping, CAD/CAM/CAE & PCB systems. Programming in Pascal, C, Unix, Fortran, Assembler, Micro-code. Experience with Preq, Apollo, VAX, HP, CDC Cyber computers. MS degree in comp. sc. and 2 yrs exp as software eng. required. Job & interview site: San Diego, CA. Salary: $34,992/yr. Send this ad and your resume to Job #CR9076, P.O. Box 9560, Sacramento, CA 95823-0560 not later than 11/24/86.

Programmer/write, design and implement software packages relating insurance companies. Work with micro computers and various programming languages in custom configurations of software packages designed to augment and computerize operations. Data gathering and data retrieval in business. Consult with clientele requirements modifications, operations instructions for new software equipment. Fluent in languages, C, Pascal, Turbo Pascal, Fortran, Assembly. Must be familiar with 'local area' networks. Must have good knowledge of data structures such as Heaps, Tries, Linked Lists etc. BS in Computer Science. 3 months experience or 3 months experience as a consultant or assistant. Job site and interview, Culver City, California. Rate of pay $25,000 per year for 40 hour work/week. Send this ad and your resume to Job #FC9346, P.O. Box 9560, Sacramento, CA 95823-0560 not later than November 19, 1986.

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Fujitsu Microelectronics, Inc., a recognized leader in semiconductor technology, has exciting opportunities for professionals in our MIS Division, to be involved in our conversion to an AMDAHL 5840 and the replacement of all our business systems. If you're a motivated individual and want to work as a team player in the forefront of hardware and software technology, here's what we are looking for.

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As a member of the Systems and Programming Group in our Management Information Systems Department, you will be involved in all facets of systems development and maintenance, including analysis, design, and actual implementation.

You must be an individual who takes the initiative and communicates well with both users and MIS personnel. You should possess a strong analytical ability, technical background and have a deep appreciation for business and management requirements. This will help us attain our goal of totally integrated systems which provides all levels of management with the information needed for our company's growth.

Qualified applicants will have a Bachelor's degree, or equivalent, preferably in Business or Information Systems. You must have 5+ years of programming/analysis experience with IBM Series 43XX or larger, or a plug compatible machine. Your background should include 2 years of application support for IDMS or IDMS/R database system. Experience with Cullinet business applications and tools, such as ADS/O, ASF, and ADS/B preferred.

Send resume to Fujitsu Microelectronics, Inc., Dept. CAE, 3320 Scott Blvd., Santa Clara, CA 95054-3197. An equal opportunity employer m/f/h.

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SYSTEM PROGRAMMERS

These positions will involve installing, supporting and maintaining the OS/MVS/XA operating system in a large-scale IBM environment. Heavy interaction with end-users, applications personnel and vendors is required.

Viable candidates will have had a minimum of three years of software experience, at least one of which as a systems programmer, in an OS/MVS environment, including demonstrated use of Assembler language. Experience with SMPE, VTAM, VSAM and IDMS would be beneficial.

Please forward your resume and salary expectations to Peter A. Capodilupo, Staffing Consultant, Boston Edison, P-264, 800 Boylston Street, Boston, MA 02199. An equal opportunity employer. M/F/HDCP.

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Major F500 mfr seeks Systems Programmer to install & support compilers, security sys & purchased software. Prefer MVS bkgrd. Located in delightful rural setting, offers oppty to grow into full MVS Systems Programmer. To **$35,000**

ROBERT HALF
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Buffalo, NY 14202
(716) 842-0801

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Prestige Twin Cities area industry leader is urgently in need of a systems analyst to design & develop new business applications in MVS/XA 3090 environment. Req's 3-5+ yrs total data processing experience and strong on-line or data base skills. To Low **$30,s**

Mark David
ROBERT HALF
of Minnesota
3636 IDS Center
Minneapolis, MN 55402
(612) 339-9001

NASHVILLE

DATA BASE

Various positions exist for data base professionals with project development skills or installing and tuning experience. Environments include ADR Datacom, IDMS/ADSO, DB 2 and IMS DB/DC. To **$42,000**

SYSTEMS PROGRAMMER

Responsible for supporting CICS in a MVS/JES 2 environment. Experience with NCP or VTAM are pluses. Opportunity to upgrade with shop to latest CICS release, 1.7. Mid **$30's**

SYSTEM 38

Must have 2-4 years System 38 and RPG III with strong analytical skills. Looking for someone with mgmt potential. Opportunity to advance to mgmt in 2 years. **$30,000**

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MVS SOFTWARE SPEC

IBM/MVS opn sys internals bkgrd req'd for this area data center opening! Will become sr tech support indiv for this blue chip corp. Salary **$38-45,000**

SYSTEMS/ANALYST

Hartford area oppty's for P/A's & S/A w/CICS & IMS or IDMS exp. 2+ yrs exp req'd for an oppty to work in state-of-the-art IBM environ & implement data base sys. Our client will provide data base training for qualified candidates w/2 yrs of COBOL. Excellent oppty for indiv's seeking growth & advancement. Paid reloc. Salary to **$37,000**

P/A MFG SYSTEMS

Join a team respon for devel corp mfg support sys. This req a strong bkgrd in mfg apps. Position offers hi visibility, excellent growth potential. Co will provide training. CICS or D1-1 expreq'd. Salary to **$36,000**

DP MANAGER

S/38 exp plus strong staff mgmt skills is sought by this major dist firm. Step into new data center in VA location. Salary to **$50,000**

SYSTEMS (IDMS)

New Eng clients seeking sys/analysts-prog to join devel staff in IDMS/COBOL fin'l apps. Full reloc, excellent benefits, suburban & rural locations. Salaries to **$43,000**

ROBERT HALF
of Hartford
111 Pearl Street
Hartford, CT 06103
(203) 278-7170

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MANAGER OF MIS

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ROBERT HALF
of L.A.
3600 Wilshire, #2000
Los Angeles, CA 90010
(213) 386-6805

BOSTON

SYSTEMS AUDITOR

Prominent div of F100 corp seeks tech astute pro for hi-vis role on EDP audit staff. Large IBM/COBOL bkgrd w/apps & design reviews desired as is CIA, CISA or CPA. Exceptional mobility w/career catalyst oppty! Salary to **$42,000**

PROJECT LEADER - BANKING

This growing fin'l investment svcs firm seeks well-versed tech contributor for lead role in banking sys devel. If you have exp in IBM OS/MVS, COBOL, CICS & proj leadership, this oppty is for you. Hi-vis position in on-line CIF devel. Salary to **$40,000**

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(617) 423-1200

WISCONSIN

SR SYSTEMS ANALYST

If it's time to move up, then consider this firm that requires 5+ years in manufacturing systems, 2+ years COBOL & knowledge of CICS and/or Tandem. IBM experience helpful. **$32-38,000**

DATA BASE ANALYST

Here's a real opportunity with a billion dollar food distributor if you have 3+ years with data base technology, 2+ years DOS/VSE, IDMS, DL/1 and have IBM experience. **$28-32,000**

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777 E. Wisconsin Ave.
Milwaukee, WI 53202
(414) 271-HALF (271-4253)

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IDMS DBA

Major mfr is looking for an IDMS Data Base professional. Minimum requirements are: 2 yrs exp with IDMS applications programming or data base analysis, good communication skills - written and oral. Will maintain and tune IDMS/R. Salary to **$33,000**

PROGRAMMING SUPERVISOR

Small 43xx shop needs a solid Prog Analyst to become #2 person in Data Processing. Must have 4 yrs exp as a Prog. Will perform duties of a Sr Prog Analyst, but will also be looked upon as DP Mgr in the Mgr's absence. Get involved in hardware-software selection, set Dept standards, staffing, performance evaluations, etc. Salary to **$37,000**

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of St. Louis
7733 Forsyth
St. Louis, MO 63105
(314) 727-1535

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Strong management skills. Will direct office automation to modify text processing. Salary to **$42,000**

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(513) 224-0600

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(512) 835-0883

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of Oklahoma
1601 N.W. Expressway
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1395 Charlotte Plaza
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(704) 339-0550

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ROBERT HALF
of Providence
900 Turks Head Building
Providence, RI 02903
(401) 274-8700

SENIOR SYSTEMS ANALYST

La Quinta Motor Inns, Inc. is seeking a Senior Systems Analyst for the installation and support of Sperry 1100 System software components, including OS/1100, CMS/1100, DMS/1100, and MAPPER. Also responsible for participating in the design and programming of applications, and support of MAPPER users.

Qualified candidate will be competent in COBOL, MASM, and MAPPER and be able to generate, install, and support Sperry 1100 system software. In addition, candidate will possess a strong interest in programming, system support, and user satisfaction.

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DP Recruiting Manager
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3705-320 Latrobe Drive
Charlotte, NC 28211

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Position in Spokane, Washington. Salary $27,763/year. Work schedule generally 40 hours/week. Extensive overtime required during installation.

Duties: designs, develops, documents, evaluates and installs system level software; performs assembly and high level language programming on IBM Series/I and IBM PC; performs research of operating systems, languages, communication protocols, and utility package subsystems to fulfill design requirements for electronic field operations system; troubleshoots systems level software; supervises 5 professional level programmers.

Requirements: BA or BS in Computer Science and 3 years' employment experience in related occupation - 1 year may be credited if applicant has Master's degree in Computer Science or Computer Engineering. At least 2 years' employment experience programming IBM Series/I utilizing EDL; 1 year employment experience programming IBM PC utilizing C and 8086 assembly. Experience must include project control for at least 1 project installation (employment experience can be simultaneous).

Qualified applicants should send resume to: Employment Security Department, ES Division, Attn: AEC 45737, Olympia, WA 98504.

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Consult with departments to identify business problems and recommend potential automated solutions. Performs detailed analysis of business process to determine information requirements. Will develop functional specifications and participate in detail system and data base design. Plans, coordinates and monitors project activity. Requires 3 years experience in applications development and system analysis (full life cycle experience). Must be knowledgeable of structured techniques, understand the general business process and possess strong interpersonal and communication skills.

SR. PROGRAMMER ANALYST

Performs technical design, development and maintenance of complex computer programs. Routinely coordinates the work of programming teams and will work on multiple assignments concurrently. Interacts with users and systems analysts to provide development support. At least 3 years of programming and analysis with strong COBOL skill in an IBM/MVS environment needed. Requires knowledge of structured design and programming techniques with above average analytical and communication skills. CICS and IDMS experience preferred.

PROGRAMMER ANALYST

Will perform a variety of programming assignments involving medium to large-scale systems. Responsible for independent problem analysis and program development from design through implementation. Will participate in the planning and estimating of programming tasks. Two years of COBOL programming in an IBM/MVS environment and knowledge of structured programming techniques required. CICS and IDMS preferred.

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Position available requiring FOCUS and SAS skills in a TSO/ISPF environment. Additional positions exist for individuals with IBM consultant-level skills and working knowledge of LOTUS, DATAEASE or WORD.

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YOUR RESUME:

- Should reveal two or more years of experience within a large OS Mainframe environment;
- Must include evidence of state-of-the-art problem solving skills;
- Knowledge of COBOL with CICS Command Level languages essential.

Interested individuals are invited to write or call: (312) 986-8800 Ex. 3130, Kathy Kanzer-Johnson, Spiegel, Inc., Regency Towers, Oak Brook, IL 60522. An equal opportunity employer m/f.

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ASSISTANT DIRECTOR, ADMINISTRATIVE SYSTEMS

Computing and Data Processing Services

Applications and nominations are invited for this new position to manage our administrative information systems.

Computing and Data Processing Services supports administrative and academic computing throughout the multicampus 28,000 student University of Maine System. Over 1000 terminals connect to the broad range of facilities typical of combined centers. Access and control of computing within the University is widely distributed and well developed systems exist in the principal application areas. Major enhancements, including an integrated student system and database environment, are in the planning stage.

The Assistant Director will lead this project, manage existing systems and the application of state-of-the-art computing technology to administrative systems, and supervise the development group, currently including six professionals. Based in Orono, this individual will be the principal contact to senior administrators throughout the University regarding administrative computer systems.

The position requires a Bachelor's degree and at least five years of progressively more responsible experience in systems development, project management and supervision. Preferred qualifications include an advanced degree, and experience:

- in the support of academic administration
- with IBM Operating Systems, online systems and DBMS
- with microcomputers and LANS.

Formal review of applications will begin on November 17. Please send applications and nominations to **J.E. Johnson, Director of Computing and Data Processing Services, University of Maine System, 107 Maine Avenue, Bangor, Maine 04401-1805**

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Dr. Thomas H. Athey
Cal Poly University
School of Business Administration
3801 West Temple Avenue
Pomona, CA 91768

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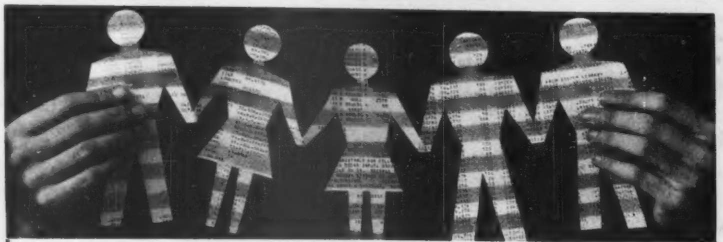

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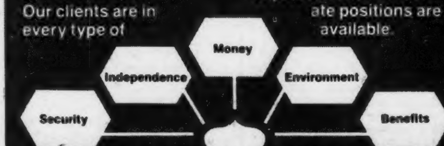

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If you qualify for our services and would like to explore career advancement, call 800-222-0153 or (in NJ) 609-667-4488, or send a resume with education, experience, salary, desired salary and location restrictions to either address:

RSVP SERVICES, Dept. C2
One Cherry Hill Mall, Suite 700
Cherry Hill, NJ 08002

RSVP SERVICES, Dept. C2
Dublin Hall, Suite 201
1777 Walton Road
Blue Bell, PA 19422 (mail address only)

RSVP SERVICES
Employment Agents for Computer Professionals

NY METROPOLITAN AREA

Programmers (minimum 1 yr exp) thru Project Mgmt levels - previous financial exp or college degree are both pluses. Benefits range from 4 wks vac to on-site health club, and limited reloc.

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Any Database-P/A thru Sys Prog	$28-50K
● TANDEM Apps or Sys Prog	
TAL, COBOL or FORTRAN	$25-50K
● DG Systems or Applications	**$25-42K**
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C or Macro	$25-48K
ARBAT/AIMS	$30-45K

Contact Dean Nardone
HOWARD-MICHAELS ASSOC.
60 E. 42 St., Suite 616, NYC 10165
(212) 661-5170

SYSTEMS ANALYST - Respon for building an auto teller machine cash dispensing sys for NYS bank which req applications design, programming, quality assurance, testing & documentation (applications & user). 3 yrs exp or 3 yrs related programming exp. Bach. - Any Field, Must know COBOL, Command Level CICS, VSAM, DOS/VSE, ICCF & EASYTRIEVE on lg IBM mainframe hardware. $35,000/yr, 40hrs/wk. Datronics, Inc., 675 Third Ave, NYC 10017. Send resume.

DATA PROCESSING OPPORTUNITIES

The Department of Management & Information System Services of the University of Medicine and Dentistry of New Jersey, charged with the implementation of a distributed data processing network serving our campuses in Newark, Piscataway and Camden.

Opportunities now exist for:

- **Assistant Director of Development**
- **Programmer Analysts, 2-3 years COBOL/CICS/-DOS/VSE**
- **System Programmers, 2-3 years experience, VM/DOS/VSE preferred and/or 8100 DPPX**
- **Systems Analysts, accounting background preferred.**
- **Senior Computer Operators, I/O, Librarians.**

You will operate in an environment that includes network dual IBM 4381, utilizing *VM/VSM*, ACF/NCP in support of IBM's 8100 distributed systems, the New Jersey Educational Computer Network and the University's HP scientific network.

Project teams are now being staffed to support the full spectrum of financial, human resource, academic administrative and health care systems needed by this comprehensive state-wide medical delivery and educational institution. You will be using such state-of-the-art development software as VM/CMS/SPF, a data management dictionary, DL/1, CICS/VS, 8100 DPPX and high level application development tools, ADS, easytrieve SQL as well as the standard support languages.

Please send resume with salary requirements to:

Linda Groce
UMDNJ - Dept of Personnel Resources
30 Bergen Street (CW)
Newark, NJ 07107-3007
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UMD
NEW JERSEY

POSITION ANNOUNCEMENTS

PROGRAMMER/ANALYSTS

Rapidly growing MIS Department of Osceola County has openings for three (3) Programmer/Analysts. These positions require 3+ years of programming governmental applications using IBM DOS/VSE, CICS command level COBOL, VSAM, ICCF and JCL. Experience with a fourth generation language such as IBM's Cross Systems Product is a plus. Position involves project analysis, program development and direct involvement with end users throughout the development-production cycle.

PROJECT LEADER

Position requires background similar to Programmer Analyst, but with more depth. In addition, individual must have experience managing programmers as well as interfacing with user community. Proven project management skills are mandatory.

SALARY IS NEGOTIABLE.

Resumes accepted thru November 10, 1986 by **Eleanor Anderson, County Administrator, 17 S Vernon Ave., Kissimmee, FL 32741**

ENGINEER, AEROSPACE: Dev & validate three-dimensional unsteady viscous flow codes for arbitrary rotocraft configurations consisting of rotating & nonrotating components; dev & extend current methodology for zonal grid topologies of fixed & moving blocks from two to three dimensions; modify existing three-dimensional Euler code to include rotational effects & to incorporate the zonal grid structure for rotating & non-rotating components using time-accurate algorithm; extend Euler code to Navier-Stokes algorithm & solve the realistic helicopter aerodynamic problem; display computed results using IRIS workstation. $2916.66/mo. PhD in Aerospace Eng reqd. Knowledge of running large CFD codes on supercomputers, viscous transonic flow, flow solvers for the Navier-Stokes equations, ARC2D computer code, IRIS graphics workstations, grid generation schemes, turbulence modeling & porosity modeling reqd. Job site/interview: Palo Alto, CA. Send this ad & resume to Job #MD9014, P.O. Box 9560, Sacramento, CA 95823-0560 not later than November 18, 1986.

Honeywell Programmer/Analyst

Metro National Corporation requires a Programmer/Analyst to work with its Honeywell DPS/8 computer system. Position will involve developing new systems while maintaining and enhancing existing system.

The successful candidate will have

- One to three years programming experience.
- B.S. in Computer Science.
- Knowledge of Cobol 74.
- Experience with DMIV TP, DMIV TPFO, and GCOS 8.
- Applications programming of financial systems helpful.

Please send resume and salary history to

Cindy Appleman
Metro National Corporation
P.O. Box 19509
Houston, Texas 77224-9509

Director Of Research And Development

Electronics manufacturer in the St. Louis area seeks a highly qualified Electrical Engineer to take responsibility of research and development department. Responsibility includes production design, product reliability, implementation of development program in coordinating product planning with marketing. Will act as engineering liaison inside and outside the company. Must be extremely familiar with European market and have technical knowledge of laser printers. Requires a MSEE or equivalent and a minimum ten years experience in research and development management. 40 hours per week. Annual salary $80,000. Send resume to Missouri Job Service, 505 Washington Avenue, St. Louis, Missouri 63101, Attn: K. Gooch. Refer to Job Order 024247. An EOE Employer.

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We're looking for talented, dedicated computer professionals for the following positions:

Project Management Engineer
You will manage and direct multidisciplinary teams involved in the analysis, design, implementation, maintenance/enhancement, and hardware acquisition and installation of computer systems. You should have a Master's degree or equivalent experience in Computer Science, Information Management, or Engineering Science. Familiarity with project management principles through either formal training or work experience is required, as is knowledge of data processing methods, ADP equipment types, operating systems, and applications. Five to seven years related experience is desired.

Computer Systems Analyst/Programmer
You will provide technical support in the performance of project-oriented studies and hardware/software development, as well as contribute to the maintenance of computer systems. Three to seven years experience and a BS degree in Computer Science, Information Management, or Engineering Science is required. Broad knowledge of data processing methods, ADP equipment types, operating systems, applications, and project/task management principles is necessary.

Computer Systems Analyst
You will provide leadership and technical direction in project/task-oriented studies and hardware/software development activities for computer systems. A Master's degree or equivalent experience in Computer Science, Information Management, or Engineering Science is required. Five to seven years experience is highly desired, and familiarity with data processing methods, ADP equipment types, operating systems, applications, and project/task management principles is essential.

Systems Programmer
You will be involved in all phases of software engineering—developing requirements for proposals, monitoring the technical aspects of contracts for both hardware and software systems, and contributing to large-scale projects as a member of a project team. Four to ten years experience in the design, development, implementation, documentation, and maintenance of software systems for IBM or compatible equipment (including VM, MVS, JES3, CICS, or CMS systems) is required. Experience with Cray supercomputer is desired. A BS degree in Computer Science or a related discipline (or equivalent experience) is necessary.

Instructor—ADP
Your vital contribution will be in the design, development and conducting of courses for DP professionals, creating and evaluating computer-based education and other self-study programs, and managing contracted instruction efforts. A BS degree or equivalent experience in Education, Computer Science, Information Management, or Engineering Science is a prerequisite. Five years or more of directly applicable experience in data processing, as well as one year teaching experience is highly desirable.

Electronic Engineer
Your responsibilities will include developing equipment specifications, evaluating and monitoring contractor performance, and participating in design reviews. A BS degree in Computer Science is required, and an advanced degree in Electrical or Computer Engineering/Science is desired. Two to four years work experience with broad-based and detailed knowledge of computer hardware, communication interfaces, protocols, microprocessors, communications software, and terminals is necessary.

Your skills and diligence in each of these capacities will be rewarded with a competitive salary, excellent career growth potential, and outstanding benefits. Plus, your position with the CIA will afford you access to a myriad of cultural, athletic, and educational attractions in Washington, D.C., our nation's capital. For immediate consideration, send your resume to:

Personnel Representative (AA01)
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2D04 Headquarters
Washington, D.C. 20505

Written inquiries only. We will respond within 30 days to those judged to be of further interest.

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Central Intelligence Agency

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COMPUTER OPERATIONS SUPERVISOR needed for dual IBM 4381 shop supporting VM, MVS, VSE, and CICS environment. Will supervise staff of 11 computer operators working all three shifts, 24 hours/day, 7 days/week. Previous supervisory experience in an IBM environment highly desirable. Proven ability to work long hours in high pressure situations, and on rotating shifts is also desirable. Salary range: $23,936 - $32,682 per year. Applications must be received by November 14, 1986. Apply to: University of Virginia, Department of Personnel Administration, Carruthers Hall, 1001 North Emmet Street, PO Box 9007, Charlottesville, VA 22906. An equal opportunity/affirmative action employer.

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Software development shop has immediate openings for qualified professionals with background in:

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Attn: Russ Mahy

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SYSTEMS ANALYST – Respons for design & developmt of various insurance progs for lg health insurance firm, maintaining existing systems under DOS/VSA environment. Specifically: study existing systems & ID chgs to implement co opert'l policies; develop & design subsystems to support implementation of projects; develop prog specs for new progs; modify, design, code & document progs. 2 yrs exp or 2 yrs rel systems analyst exp. Must know COBOL, NATURAL/ADABAS, IDMS/DB, ADSO, DL/1, VSAM, DOS/VSE & large IBM mainframe hardware. Bach degree in Math or Comp Sci. $36,000/yr, 40 hrs/wk. Pinkerton Computer Consultants, 20 Broad St., Suite 1302, NYC 10005. Send resume to Ms. Joyce (#20).

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Northrop Defense Systems Division is among the fastest growing enterprises in an expanding electronic countermeasures industry. Work in the design, development, and manufacture of highly sophisticated electronics has positioned Northrop DSD as one of this industry's leaders utilizing computer-based scientific programming. Attractively situated in one of Chicago's northwest suburbs, Northrop invites individuals with a BSCS or equivalent, and relevant experience to participate in NEW systems development utilizing on-line and DB technologies.

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SR. PROGRAMMER ANALYST
SYSTEMS ANALYST
SR. SYSTEMS ANALYST
SYSTEMS PROGRAMMER
SOFTWARE ANALYST
OPERATIONS SUPPORT TECHNICIAN
DATA BASE TECHNICIAN
BUSINESS SYSTEMS SPECIALIST
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CAPACITY PLANNER
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Financial Applications

Financial programming applications using VSAM, COBOL, MVS, CICS, or ADS/O, with background in payroll/personnel systems. Background in MSA, IDMS, PANVALET, structure coding, SYSD, and other financial systems a plus.

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Utilizing CICS, VSAM, COBOL or ADS/O or UFO to design, code, test, install and support systems. Involves user contact and requires good communication skills.

Information Resource Management Data Center

Positions require high technical expertise in computer operations, technical support, data base administration and computer resource planning, with specific experience contingent on assigned area. Major products used are MVS/XA, JES2, SNA, IDMS Products, Marino Software, UCC Products, CICS and TSO.

We invite your inquiries and your resume. Write: **Employment Representative M.S.M., Northrop Corporation, Defense Systems Division, 600 Hicks Road, Rolling Meadows, IL 60008.** We are an equal opportunity employer M/F/V/H. U.S. Citizenship Required.

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POSITION ANNOUNCEMENTS | POSITION ANNOUNCEMENTS

COMPUTER PROFESSIONALS

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Our Executive Management has committed support to our Systems Division to facilitate replacement of current major systems to keep pace with our rapid interstate growth. We have the resources and growth to offer you an outstanding career interfacing with top professionals and working in a state-of-the-art environment. Charlotte's environment includes Twin IBM 3090-200's, MVS/XA and IMS DB/DC. Tampa's includes twin 3081's, MVS/XA, CICS and IMS DB/DC.

Challenges exist for:

IMS SYSTEMS PROGRAMMER

1-2 years experience in an IBM environment working in IMS System Generation, IMS utilities, and IMS maintenance and support. Tampa location.

SYSTEMS ANALYSTS

4-8 years total systems experience. 2+ years designing and implementing systems in an IBM environment. Banking experience, particularly HOGAN, very helpful. Charlotte and Tampa locations.

DATA BASE ANALYST

Prefer candidate with experience as an IBM Data Base Analyst supporting HOGAN umbrella software. Will also consider candidates with 2 years experience as a Data Base Analyst in an IMS environment or candidates with 2 years HOGAN experience.

Please send a resume and salary history to: NCNB, Personnel Department, T12-2 (LR-C), Charlotte, NC 28255.

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EXECUTIVE DIRECTOR ALABAMA SUPERCOMPUTER NETWORK AUTHORITY

The Alabama Supercomputer Network Authority, in conjunction with the Department of Finance, is charged with the establishment of a supercomputer center to provide services for the educational, research, and industrial needs of the state. The authority invites nominations and applications for the position of Executive Director. The supercomputer will be physically located in Huntsville, Alabama with statewide access through a high speed telecommunications network with major nodes located throughout the state. The executive director and his or her staff will provide the management and direction of the program and will report directly to the authority.

RESPONSIBILITIES OF THE EXECUTIVE DIRECTOR:

1. To provide leadership and coordination for the facilities vendor.
2. To consult with the community of users and establish procedures necessary for fair and equitable access to the supercomputer.
3. To insure the quality and proficiency of the services provided by the facilities vendor.
4. To provide and execute a marketing plan which insures the best and maximum use of the supercomputer for the development of the State of Alabama.
5. To advise and instruct the facilities vendor regarding acquisition of hardware, software and any general service enhancement.
6. To serve as the primary representative of the authority in liaison with the executive and legislative branches of state government.

QUALIFICATIONS:

1. An earned master's degree, doctorate preferred.
2. A minimum of ten years of progressive experience in the overall management and/or coordination of high level computing services preferably with supercomputer involvement.
3. Substantial experience in a university and/or organized research environment with a high level of computer use.
4. Proven ability to organize and market services to diverse clientele.
5. Demonstrated competence in managing the fiscal affairs of large organizations providing computing services.

Applications or nominations must be received by December 15, 1986.

Salary is competitive and negotiable depending upon experience and qualifications. Applications or nominations and requests for information should be directed to:

V. Gordon Moulton
Vice President
AD 205
UNIVERSITY OF SOUTH ALABAMA
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SYSTEMS PROGRAMMER

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We are looking for a degreed professional. Experience in a similar environment is a plus. If you are looking for career opportunity with a high-growth, fast-paced organization, consider Perrigo.

We offer an excellent salary and complete benefit package. Send resume and salary requirements in complete confidence to:

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Geisinger

MIS Professional Opportunities

IBM Environment

Geisinger System Services is the management support unit to a 569-bed tertiary care medical center, 230-bed acute care hospital and several other health care affiliates. Our centralized DP system with multiple location users provides data processing professionals with state-of-the-art challenges and advancement opportunities. Our on-line environment utilizes an IBM 3083 with MVS, CICS, TSO/ISPF, VTAM and FOCUS plus multiple VAXs with VMS ethernet and MUMPS. Continued growth in our MIS department has created career opportunities for:

Assistant Manager of Technical Resources

Five years technical support and/or systems software experience with at least two years supervisory experience required. Experience with the installation of IBM software (MVS/XA, VM, CICS, TSO, VTAM via SMP) as well as non-IBM software required. Experience with the maintenance of a complex data communications environment with access to multiple CPU's by asynchronous and synchronous devices required. Experience with DEC architecture, especially VAX hardware and MUMPS software desired. BS in Computer Science or related field required.

Senior Systems Programmer

Three to four years experience as a systems programmer including one to two years experience with MVS/XA required. Capacity planning experience including tracking and projection skills for major system components (CPU, MEMORY, DASD) required. BS in Computer Science, related field or equivalent experience required.

Senior Analyst Programmer

Three to five years experience in the design and programming of clinical information systems, including cardiology systems required. Ability to interact effectively with clinical and medical personnel required. Experience with both MUMPS and PCs is highly desirable. BS degree required.

Analyst Programmer

Three years of programming/analysis experience utilizing MVS-JCL, COBOL, CICS, TSO/ISPF and VSAM required. MSA Financial Systems software experience preferred. BS in Computer Science, related field or equivalent experience required.

Geisinger System Services

All applicants must demonstrate the ability to work independently and have excellent communication skills. We are seeking experienced, aggressive individuals who are extremely user oriented. Geisinger System Services offers an excellent compensation package and a full range of benefits. For consideration, send your resume including salary history and requirements to **Human Resource Dept., Geisinger System Services, Danville, PA 17822.** An Equal Opportunity Employer, M/F.

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To qualify, the candidate should possess a BS in Computer Science or equivalent, knowledge of several high-level programming languages and experience with either MVS or CMS. Project leadership experience and excellent verbal and written communication skills are also required.

Please send resume and cover letter to
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SYSTEMS ANALYST

Enjoy the beautiful Northwest with Oregon's leading workers' compensation insurance carrier. We have an immediate opening for a computer professional experienced in insurance functions. This position requires the ability to analyze business functions; two years of data base and on-line design experience; excellent communication skills; must have experience on large IBM compatible mainframes; experience with CICS, ROSCOE, PANVALET, EASYTRIEVE, S2K a plus; bachelor's degree in Computer Science or Business Administration is desirable.

Starting hiring range of $26,000 to $30,000 per year plus an excellent benefit program. Please send confidential resume with salary history to:

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PROGRAMMER/ANALYST- Respon for design, develop, coding, testing, enhancement & maintenance for major NY Brokerage House, inc security processing systems. Estab standards for routing securities/monies from one location to another, estab communications links/procedures w/outside source & int. locations. Develop a "needs" file for each security. 2 yrs exp or 2 yrs related programming exp. Bach deg Comp Sc. Must know COBOL, CICS, ADABAS/NATURAL, FILEAID, TSO, MVS and lg. Mainframe hardware. $32,000/yr, 40hr/wk. Ascis Inc., 90 John St. New York, NY 10038. Send resume to (RR-44).

System Programming Manager - Maintain and enhance OS and related telecommunications for indirect auto finance application environment. Requires 4 years experience including TAL, COBOL, SCOBOL, GUARDIAN, telecommunications equipment. Salary $40,000 per annum. Job location - Woodland Hills, California. Equal opportunity employer. Resume to:

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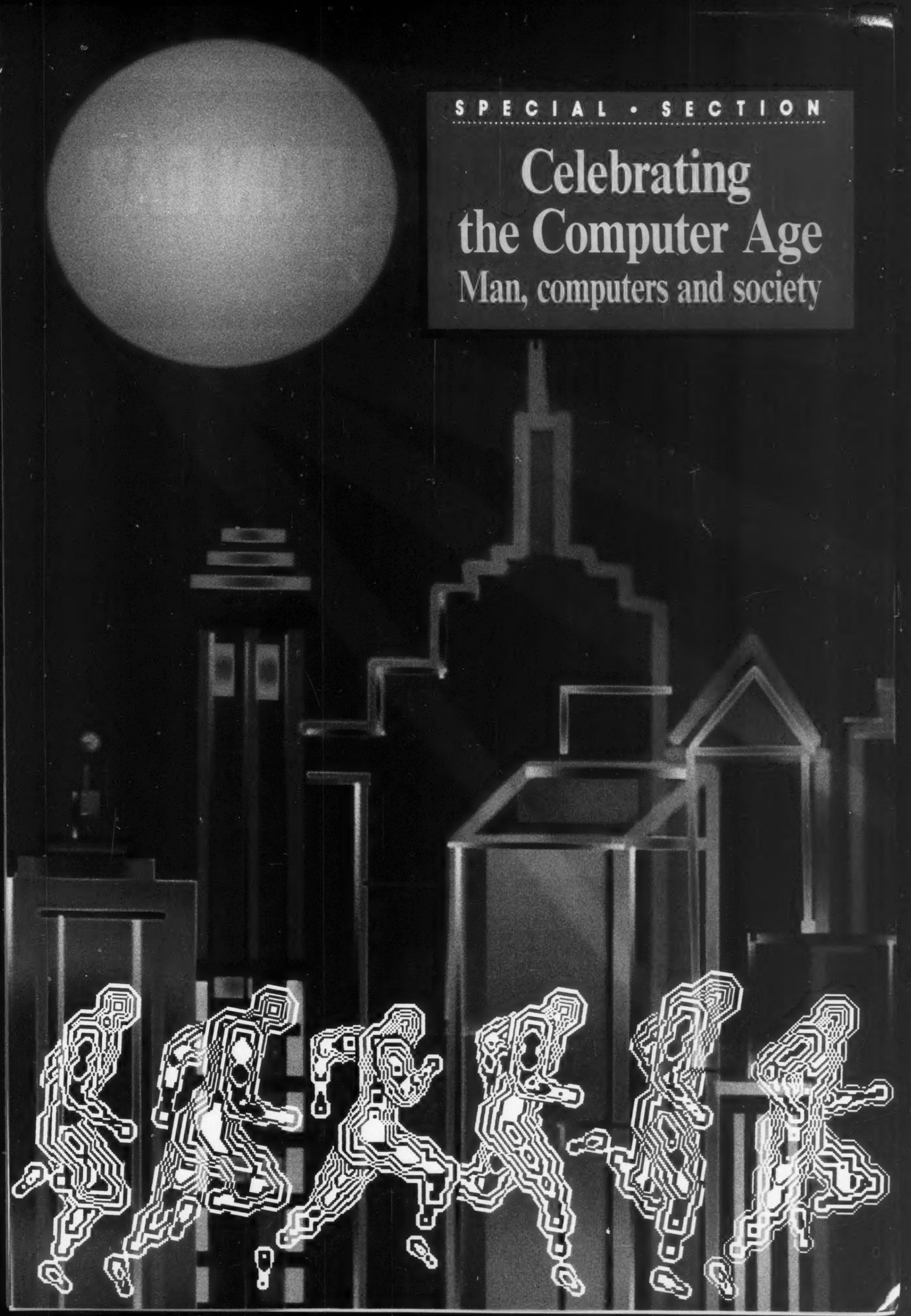
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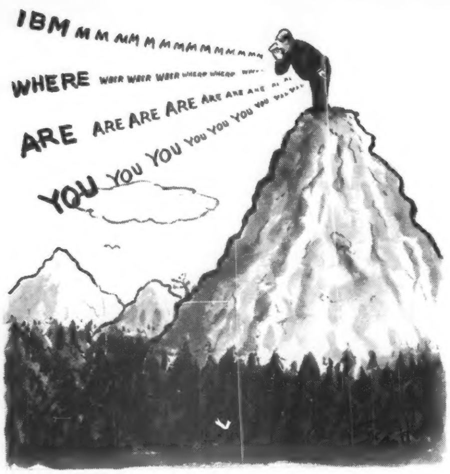

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From the president

The 40th anniversary of Eniac prompts us to ponder how computers are affecting the lives of all of us.

For centuries we managed without computers, but now it's hard to see how. The computer has made easier the work of both the public and private sectors. The federal government is the computer industry's largest customer, and computers have been vital in conducting public business and keeping the government's work force from growing far beyond present levels.

The computer has made all industries more productive while promoting the nation's economic growth and foreign trade. The computer industry's annual production of hardware and software has reached $75 billion, and its export sales have risen to $14 billion. All this means employment for more than a half million Americans.

I congratulate all who have contributed to the development of computers and wish them continued success.

Ronald Reagan

About this issue

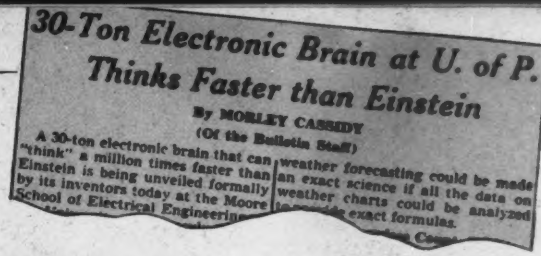
This Nov. 3 edition of *Computerworld* — our 1,000th issue — celebrates the Computer Age through the commentary of artists, educators, politicians, athletes, company chairmen, social observers, writers and industry leaders. We're focusing on one basic question: What role should computers play in society? In addition to appearing within *Computerworld*, this special section is being reprinted separately.

We measure the Computer Age from the public debut in 1946 of Eniac, the Electronic Numerical Integrator and Computer. There were worthy attempts at computing before Eniac, particularly Charles Babbage's conception of the Analytical Engine in the 1830s; Howard Aiken's very useful, though basically mechanical, Mark I in 1943; and John Atanasoff's prototype ABC, a model that lead to a judge's decision in 1973 stating that it was Atanasoff who invented the concept of the "automatic digital computer."

But none of these machines really rivaled Eniac — it was the first large-scale, fully functional, all-electronic digital computer.

More than anything, Eniac changed the definition of "computer" from "a person who computes" to "a machine that computes." In doing so, Eniac changed not only the way man counts but the way he thinks as well.

GEORGE HARRAR
Editor


30-Ton Electronic Brain at U. of P. Thinks Faster than Einstein

By MORLEY CASSIDY
(Of the Bulletin Staff)

A 30-ton electronic brain that can "think" a million times faster than Einstein is being unveiled formally by its inventors today at the Moore School of Electrical Engineering

weather forecasting could be made an exact science if all the data on weather charts could be analyzed to provide exact formulas.

In the beginning . . .

J. Presper Eckert helped launch the Computer Age in 1946 when he and John Mauchly invented Eniac, the 30-ton "electronic brain," at the University of Pennsylvania's Moore School of Electrical Engineering. Eckert, 67, still works as vice-president and technical adviser at Sperry Corp. He spoke with Editor George Harrar.

Eniac is considered the first large-scale electronic digital computer. What do you consider it?

ECKERT: It was the experimental model, not quite the prototype. The machine was not commercial in that it was for a special government agency, the Ordnance Department within the Ballistics Research Laboratory, where they actually used it for 10 years.

The interesting thing about this device was that it wasn't like the first airplane, which flew a couple of miles and proved a principle but didn't carry any useful passenger or freight traffic. This thing actually did useful work.

It was like a suspension bridge in that the first full-scale model you built had to work. It was not like the airplane or the first light bulb. By the way, Edison's light bulb was not the first light bulb. People were manufacturing light bulbs 25 years before that. They just weren't very good; they burned for just a couple of hours. His burned for 40, a tremendous improvement.

So you're saying there's the same relationship between Eniac and earlier computers?

ECKERT: Well, [John] Atanasoff claimed to have built something. Number one, if you examine his circuits and things, you find it wouldn't have worked. Number two, he applied for a patent and was told he didn't have sufficient information to apply. Number three, he had no method of program control — he didn't have the concept of subroutines. It was a rudimentary attempt that was never carried through; it was a complete failure. Why some judge inferred otherwise is hard to say. The legal system's nuts — we know this from many things.

We know John Mauchly had seen the Atanasoff Berry Computer in his visit to Iowa. Had you seen it?

ECKERT: I don't even know if he saw it. I know that he heard about it from Atanasoff and saw something there, a few tubes hooked up.

It might be equivalent to saying that Atanasoff had some ideas for storage which were never fully instrumented, and he had an idea for building an adder which he had instrumented and said worked. But nobody else knew whether it worked or not.

Some of the drawings we examined wouldn't have worked. He had no program control system worked out. He wasn't aware, as Mauchly and I were, of the concept of subroutines, and subroutines of subroutines, which Eniac allowed.

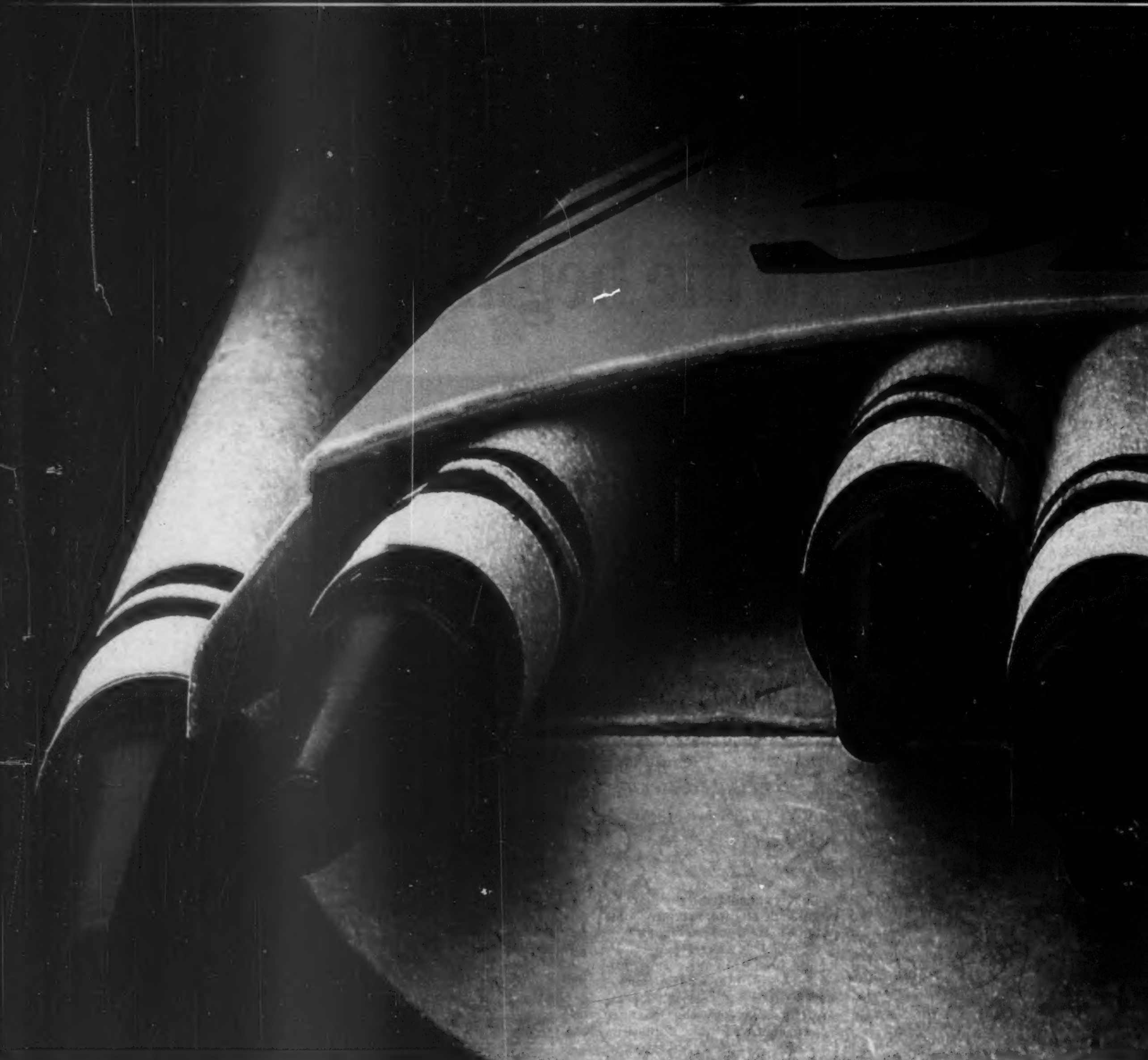
A lot of other people think Charles Babbage invented the first computer. Well, Babbage had some ideas for gears and wheels and did have some idea of programming but never got any of it to work.

How about Howard Aiken's Mark I?

ECKERT: As originally designed, it had the principle of storage, which was already in tabulators, so that wasn't new. It had the idea of transferring numbers from one register to another, but it was not done electronically. We were the first to do that electronically, which is an important difference.

The other remarkable thing about the Mark I is that it did not have the subroutine concept. If you wanted to do the same operation on successive sets of numbers, over and over, as you do in an integration of ballistics tables, you had to write out the program in machine language over and over again for each new event that arrived on the tape — a straight linear program, with no loops.

As far as I'm concerned,



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Mauchly suggested and together we instrumented the concept of program loops, and of loops within loops, and loops within loops within loops and so on.

I would say that the nearest thing to a machine that worked was Aiken's machine. But it didn't have any of the ingredients of later machines, such as internal storage.

And how about Konrad Zuse's work in West Germany?

ECKERT: He built some mechanical devices that stored information but didn't really have most of the concepts that we felt were important. He did have one concept that he tried to sell us — that is, having a whole lot of computers and throwing the information first into one and then the other, then the other and eventually back to the first, which is essentially a pipeline system. He invented the concept of pipelines, except that he was applying it to a slow mechanical device in order to try to make it fast enough to compete with electronics. We said no, electronics is going to get cheap enough [so] that even though your idea looks favorable at the moment, it's going to die as time goes along.

He claimed that some of the original work he did was destroyed in the war. Nobody can prove that one way or the other. We certainly didn't benefit from knowing about it, nor did I even hear of Babbage, nor did I know anything of Atanasoff, except that I heard he was doing something on a very small scale and had stopped it because of the war.

That brings us back to the question, how do you describe Eniac's position in computer history?

ECKERT: It was a machine that demonstrated the concept of subroutines. It laid the basis for what was later internal storage. It was the first to have fast circuits — it worked at 100 kilocycles, which for those days was fast for something reliable. It was the first execution of reliable electronic circuits.

Fermi heard about our machine, and he found out that we were going to have 18,000 tubes. He projected the failure rate and decided we were going to have a failure every five minutes. Our actual failure rate was more like once every day or every two days. We were very conservative in everything we did.

Weren't you replacing the tubes before they failed?

ECKERT: Some idiots that ran the machine for a while down at Aberdeen tried doing that, and that turns out to be a fine way to *increase* the failure rate. If a tube gets by a burn-in period of 100 hours or so, it is much more likely to have a successful life after that than a new tube.

So we created "worst worst-case design." We were also probably the first people to build electronic equipment as plug-in units, which is now taken for granted.

If a layman asks who invented the computer, do you say Eckert-Mauchly?

ECKERT: Yes. These other people didn't satisfy the conditions required by the U.S. Patent Office for an invention.

In building Eniac, did you have a sense of its importance, much as the Wright brothers could feel the drama and importance of flying?

ECKERT: We expected it to have a great impact on everything in our life. We did not expect that we could get down to reasonable cost and high reliability so rapidly.

Now there's research into putting 35 million transistors on a chip by 1990.

ECKERT: The next real breakthrough is going to have to be to cut the patterns on the chips with electron beams, which are smaller than light waves. Essentially what we have been doing is making masters with electrons to get them sharper but still making the final chips by optical methods. If things go as people expect, the next improvement is just making things smaller again. That's pretty much what it has been for the last 10 years.

You built Eniac for a particular military purpose.

ECKERT: Yes, they had an overload of ballistics problems, partly because of new weapons. Also, most of our big weapons wouldn't work right in Africa. The ground turned out to be springier and the ballistics tables wouldn't work. The guys over there were guessing correction factors. If you shot the thing and it landed off, you'd have to guess some corrections against the table. That wastes shells and gets on people's nerves. So they were anxious to get new tables out based on firing data actually made in Africa rather than in Aberdeen.

Did you foresee the commercial applications to follow?

ECKERT: Oh sure, we were familiar with punch-card machines; if somebody could use those crude things for business, so certainly something better would have a clear application.

And yet there is a famous quote from the time that there was a worldwide market for only a dozen large computer systems.

ECKERT: It was six, actually. It was from Aiken at Harvard. He said that in a speech one day. He told me exactly how he came to this conclusion. At the time I was in college, one view of applied mathematics was that the work of an engineer was to state a problem in equations then reduce this equation to a known form. Aiken's point

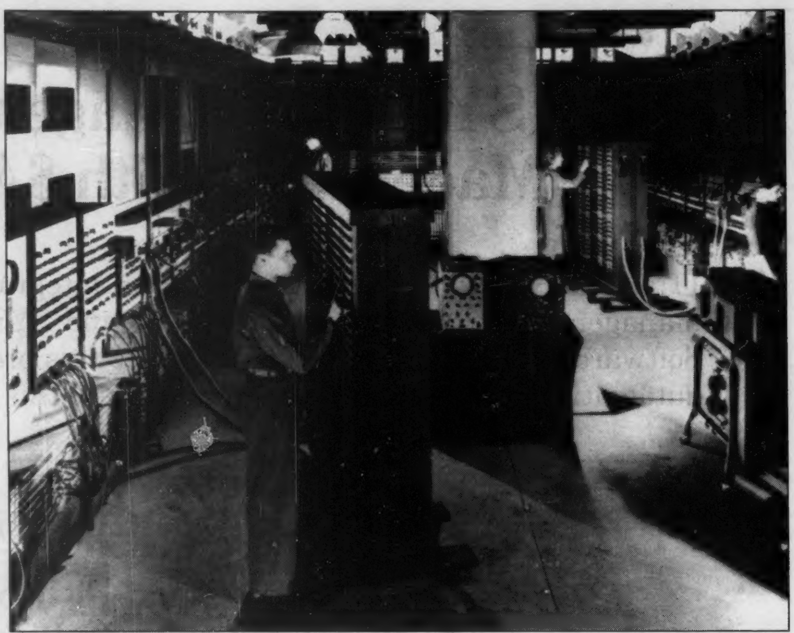
was that if we used computers to take all of the known functions that had been produced, consider the rate at which new ones were being invented and turn out books containing these thousands of pages of numbers, that would satisfy most engineering requirements. At the speed Eniac ran and with the number of tables needed, it would require about six machines.

That leaves out bookkeeping. Apparently he felt punch cards would take care of that application for the foreseeable future. He was a very dogmatic, clear-cut speaker, a tremendous speaker — he could convince anyone in a room that he was correct until they walked out and thought about it more carefully the next day. He said this very forcefully, and the word got around.

He realized very soon afterwards that this was a very narrow view of things. It was correct in the sense of what he thought about. But there were many other spheres out there that he didn't consider. He later publicly retracted that statement.

Grace Hopper worked for Howard Aiken and left him to come down and work for us. She was, in a sense, one of the world's first programmers. Certainly the various young ladies who worked for us at the Moore School programming the Eniac were also some of the first. I think she actually had worked on the programming for this mechanical machine, the Mark I, even before that.

Lady [Ada] Lovelace, a friend of Babbage, is considered to be the world's first programmer by some people because she did some programming for a semi-imaginary machine that never worked.



Today's computer rooms could hold only a portion of Eniac, which occupied 15,000 square feet at the Moore School. Technicians worked *inside* it to check the 18,000 vacuum tubes and maintain the 30 tons of hardware.

Why were all of the early programmers women?

ECKERT: We had grabbed all of the men we could to do the engineering. It was during the war, and anymore, engineers were scarce. It was difficult to even hang on to them. They brought me down for induction six times, and finally it took a letter from the head of Civil Service and the head of ordnance to keep me from being drafted.

The local draft department was irate — the head of it wasn't, he didn't want to send me; but the other two were businessmen. All of their friends' kids were being sent over to the war, and they saw no damn reason why I shouldn't be sent over.

Every time the head of the board wasn't looking, they had me drafted again. One day he was on vacation, and they dragged me in. That's the time the university got the letter signed by both the head of ordnance and the head of Selective Service. That's what it took to stop them.

So it was hard to get engineers who weren't drafted.

Some of these women were quite good. Kay Mauchly [the wife of John Mauchly] was working on the Analyzer. Some of them had been math majors. Some of the best programmers we had, though, had no more than a high school education.

Do you ever see Grace Hopper now?

ECKERT: I haven't seen her in years.

Do you know how the term "bug" originated?

ECKERT: I know how Grace Hopper thinks it originated. She tells this fanciful story. As far as I know, this was a term in use by engineers, both mechanical and electrical, for difficulties in the equipment long before Grace Hopper ever heard of any of these things. What it amounts to is that it was a new term to Grace. I've never called her up and told her that that's nuts, but it is nuts. That term was in wide use before then.

Do you own a personal computer?

ECKERT: As of a month ago, and just after I bought it I was sick for a few weeks, so I've hardly done anything with it.

What model do you have?

ECKERT: It's a Sperry IT, which is a clone of the IBM Personal Computer AT. It's manufactured for Sperry by Mitsubishi Electronics Corp. It's sold also under the name Leading Edge. It has a few slight improvements, but it is essentially the same machine.

Why did it take you so long to get a personal computer?

ECKERT: I didn't need it. I still don't need it. I got it because they offered it at a very attractive low price. I never liked the printers for small machines. They were too noisy, these dot printers and wheel printers.

So millions of people bought personal computers long before one of the coinventors of the computer.

ECKERT: Why didn't I get one? Anything I had to do I could come in and do it on some computer around here, free and easier.

I don't believe in the personal computer as a home computer. I don't think that the average person, in doing his income tax — particularly now that it's simplified — or in keeping his household accounting records, needs that. I have about 75 real estate rental properties that I have to do some accounting on. Even then, I couldn't justify a personal computer for the little work that's involved there.

The reason I bought a personal computer now is that I have some engineering problems on which I want to do some calculations at home. The machines are cheap and fast enough now that I can do it.

What about word processing as a good home use of the PC?

ECKERT: Yes, that's probably the main justifiable reason. But don't forget, they're putting word processing ability in machines that are just small inexpensive word processing machines that are probably easier to operate than most computers.

So the typewriter and the computer as a word processor are merging. As time goes on, I think we'll see dedicated word processors for people who don't want to get into anything else.

Or if you're going to play games on a personal computer, I suppose that's all right, too. But that's kind of like a hula hoop — you'll get tired of that after a while.

I don't mean to say that someday the computer won't be an important part of the household. I just don't think that's here yet.

From what you're saying, it's not that the power isn't there yet.

ECKERT: No, the power is there for what we've been talking about. But there are other applications. For instance, if I want to build a robot to dust the furniture without breaking the Dresden doll on the table, I need a sophisticated computer that operates fairly fast in real time.

The point also is that the more speed you have to throw at a problem, the sloppier the programming can be and also the more user-friendly the program can be made. A great deal of speed may be used to build a bridge between how you and I like to do things and how the machine likes to do things. We have used a lot of speed even in the present PCs to build that bridge as far as it has gone. I don't think that bridge has been built far enough yet. I think the machines are still too obscure in the way they run. It's going to be easier to throw extra speed in these machines and teach them more than it is to teach all of the population more about using them.

So there is a need for this high speed not to do these everyday things as far as the actual function goes but to build this more graceful bridge to the human being through such techniques as so-called artificial intelligence, which I think is an awful name.

Do you have a better name?

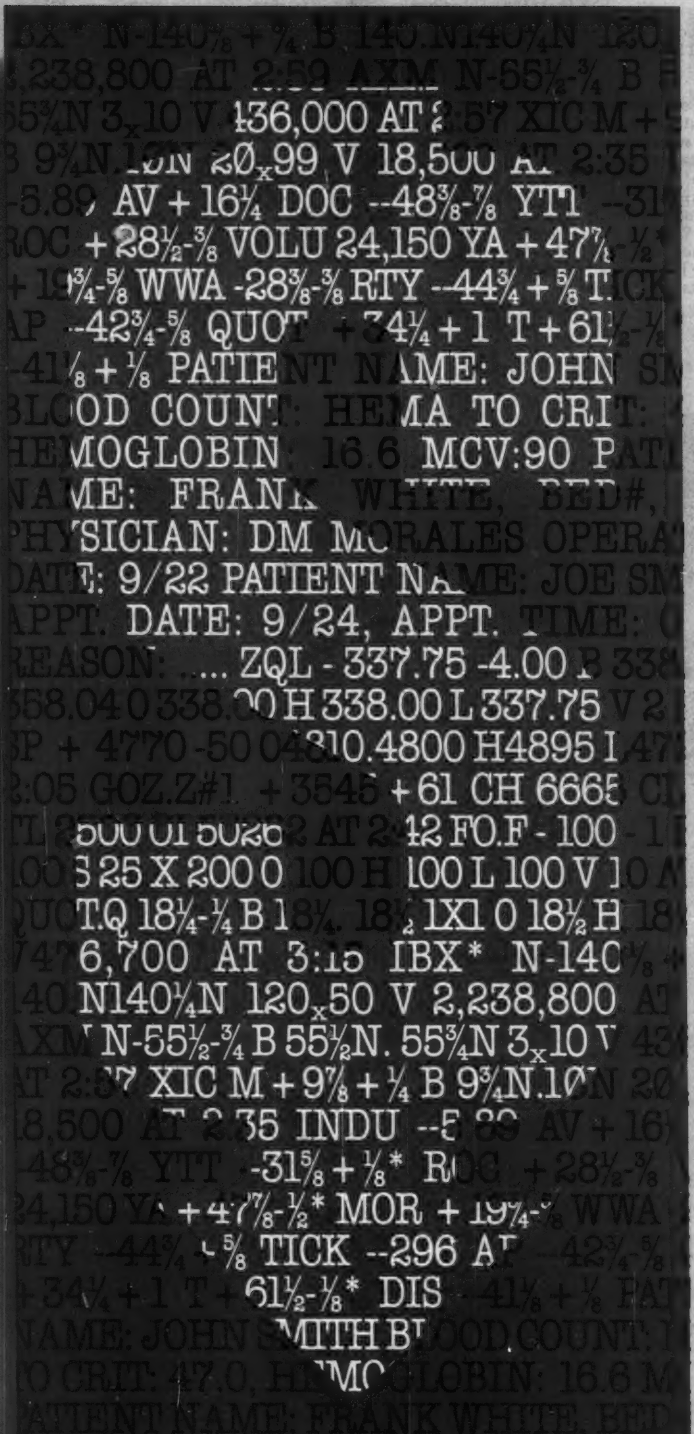
ECKERT: Oh, I haven't tried to think of a better name. "Artificial intelligence" just doesn't convey much of anything. Also, it gives a lot of misleading ideas. It's not artificial intelligence — it's a matter of putting the various gestalts that a human being uses in the machine, and it's also a matter of making the machine able to modify its own gestalts to perform these problems.

I might even consider the name "gestalt process" or something like that.

What kinds of applications do you expect from artificial intelligence or whatever you would like to call it?

ECKERT: I think it's going to influence most of our programming. But it's a speed burner.

In robotics and in home computers, where you are trying to adapt to the way a human being thinks more and you don't really need the speed to do the basic arithmetic,



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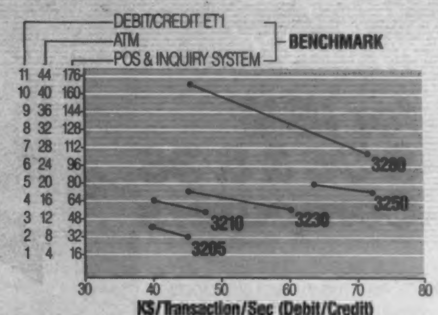

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which is frequently trivial, I think they are going to be greatly influenced by it.

Take Apple Computer's Macintosh. They burned up a good deal of the speed of the chip to make that machine have more useful displays, icons and menus. They burn up most of the speed to make that thing more edible to the human being rather than to turn out more production.

And you think that's the best way to go?

ECKERT: Oh sure. I'm not saying that the Macintosh has picked the best balance. Other people are juggling windows and all kinds of other schemes.

Do you worry about some of the great influence computers can have on society, related to something like Star Wars, for instance?

ECKERT: With atomic weapons we obviously have a tiger by the tail. The advice to let it go is hardly worthwhile. So "Star Wars" is hopefully a way to shoot a tranquilizing dart into the lion so that we can safely let the tail go. I think it's a valuable thing to do and not a potentially bad thing.

Is it feasible?

ECKERT: I don't think we know. If someone had asked us when we were building the Eniac if it was feasible, we would have said yes, and I could have produced any number of people who were saying no. I'll tell you one thing, the original Eniac could have been invented at least 10 years earlier in that the vacuum tubes that were available were not vastly different in reliability or characteristics than the ones we used.

Why wasn't it built sooner?

ECKERT: You can't really distinguish hardware and software any more, because what you put in the software and what you put in the hardware are interchangeable. The only reason you put more things in the software is to get lower cost in the hardware. And the only reason you put more things in the hardware is to get more speed out of the hardware by not depending so much on the software. They are part of the continuum of ideas. These ideas had not jelled, despite some false starts by Babbage.

Today we still have a lot of ideas in artificial intelligence that haven't jelled yet; they're just poking around, and we're trying to figure out where to put them. If people had formulated an idea about what they had wanted to do 10 years earlier or maybe even 15 or 20 years earlier, they could have done it with vacuum tubes.

When Eniac officially debuted in February of 1946, were you sure that it would work?

ECKERT: I'm not much of a worrier on things like this. I'm a person that says if it doesn't work, what do we have to do to fix it? We built a few things on a bench that worked only a few months after we started. When I saw those work and varied the voltages and frequencies and found out what the margins on them were, I said that the rest of it is just piling more of these grains of sand into the bucket until we get the bucket filled.

The first occasion that the general public had to see a large computer in action was Univac I tabulating the 1952 presidential election on TV.

ECKERT: Yes, I was there. In fact, they got the results that predicted a landslide, and the people from the network were afraid to put it on. They threw the copy in the wastebasket, and I retrieved the carbon copy — which wasn't damaged — and I still have it at home. When they decided the machine was right and all the commentators were wrong, they used this carbon copy to read what the machine had done earlier.

Everyone said, "See, people didn't trust the machine, and the machine was right, and the people were wrong."

How do you describe the value of computers to society?

I had a teacher at Pennsylvania in electrodynamics, which turned out to be a course in the special theory of relativity. He said that the problem you deal with in engineering can be divided into categories — problems of complexity and problems of perplexity.

Of course I thought of that in connection with computers. Computers take the burden of complexity off of us and leave us with the problems of perplexity. The problems that always keep us from moving to the next stage, in artificial intelligence for example, are not of complexity but of perplexity. It's just as tough now as it was for Einstein.

How do you rank the computer in terms of the great inventions of history?

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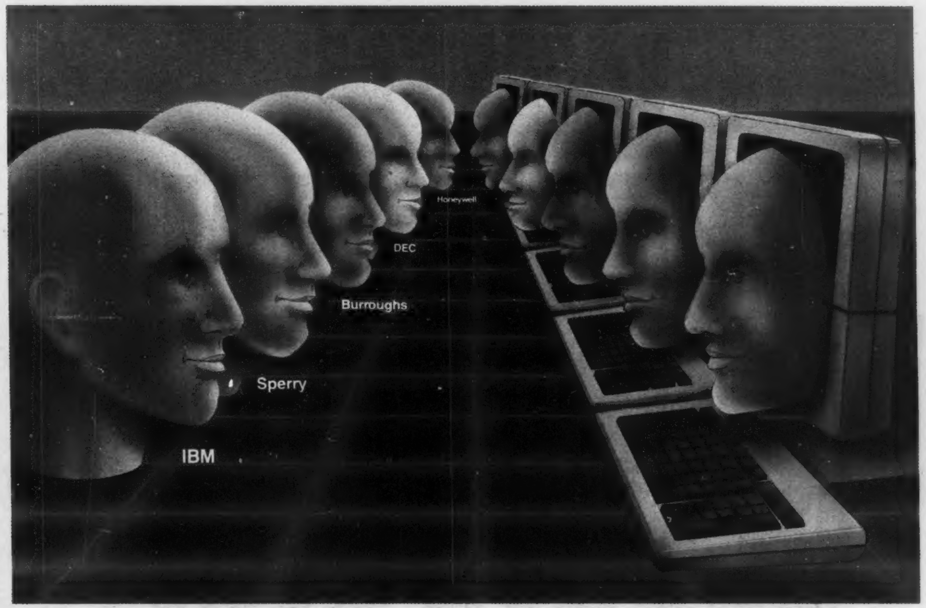

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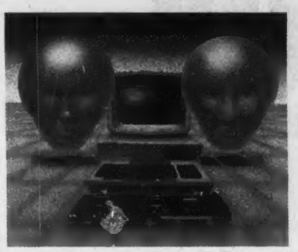

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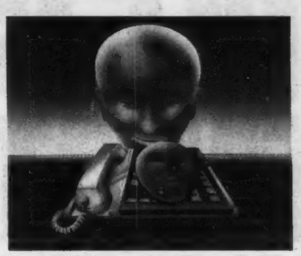

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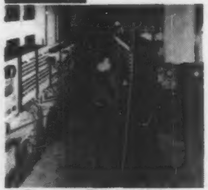
A time line, 1946 A.D. to 2000 A.D.

1946



J. Presper Eckert, John Mauchly and a team of 50 complete the Electronic Numerical Integrator and Computer (Eniac), the first large-scale, electronic digital computer, at the University of Pennsylvania's Moore School. Weighing 30 tons, standing two stories and covering 15,000 square feet, Eniac operates at 357 multiplications per second. Sponsored by the Army, the $500,000 project is aimed at designing a computer for the rapid calculation of military ballistics tables.

Though their computer is a success, Eckert and Mauchly leave the Moore School over patent disagreements a month after Eniac is unveiled and form their own company, the Electronic Control Co., to design a Universal Automatic Computer (Univac).

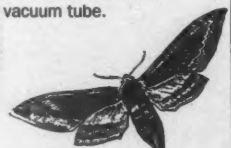
Computerworld time line compiled by **Michael Sullivan-Trainor.** Design: **Mitchell J. Hayes.** Photo research: **Christie Sears.**

Photos courtesy of: **Sperry Corp.** - Eniac, Univac I, BINAC, Univac delivered to Census; **Institute for Advanced Study** - John von Neumann; **Bureau of Census** - Walter Cronkite with Univac; **Associated Press** - Jay Forrester; **MIT Museum** - Whirlwind, Ken Olsen, PDP-1, John McCarthy; **Burroughs Corp.** - UDEC; **Control Data Corp.** - Cyber 205, Seymour Cray, students using computers; **True Basic, Inc.** - Thomas Kurtz and John Kemeny; **Stanford University** - Joshua Lederberg; **Data General Corp.** - Edson de Castro; **Intel Corp.** - 8008 processor; **Stu Rossner, Subroutines** - Thi T. Truong; **MITS** - Altair; **Cray Research, Inc.** - Cray 1; **Microsoft Corp.** - Bill Gates; **Radio Shack, a Division of Tandy Corp.** - TRS-80; **IBM** - IBM Personal Computer; **Lotus Development Corp.** - Mitch Kapor; **Iowa State University** - John V. Atanasoff; **Lanier Business Products, Inc.** - Jimmy Carter; **Compaq Computer Corp.** - Deskpro 386; **Sharon Hall** - crowd with Apple IIC.

1947

IBM decides not to invest in computers because the market, with an installed base of six units worldwide, is too small.

At Bell Labs, William Shockley, John Bardeen and Walter Brattain develop the first "transfer resistance" device, which becomes known as the transistor, a revolutionary replacement for the cumbersome vacuum tube.



Grace Hopper documents the first computer bug, a dead moth found in a cabinet of the Mark II. She immortalizes the insect by pasting it in her logbook beside a note about the incident.

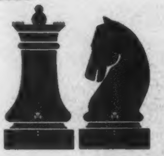
1948

Jealous of Eniac's success and miffed at Howard Aiken, who snubbed IBM at the Mark I dedication, Thomas J. Watson Sr. orders built an Eniac-like computer, the Selective Sequence Electronic Calculator (SSEC). With more than 12,000 vacuum tubes, SSEC becomes the target of cartoonists and motion picture makers, who use its huge size and flashing lights to illustrate the outlandishness of computers of the period.

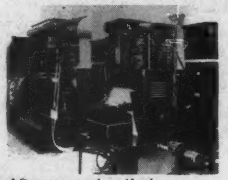
1949

Maurice Wilkes of England's Cambridge University builds the first stored-program computer, the Electronic Delay Storage Automatic Computer (EDSAC). A student at Eckert's and Mauchly's Moore School lectures, Wilkes works with a copy of John von Neumann's draft on the Electronic Discrete Variable Automatic Computer (EDVAC) to beat out the Americans.

MIT's Claude Shannon builds the first chess-playing machine, called Caissac.



Standards Eastern Automatic Computer (SEAC) and Standards Western Automatic Computer (SWAC) are built by the National Bureau of Standards as the first and second American electronic stored-program computers using all-diode logic.



After renaming their company the Eckert-Mauchly Computer Corp., Eckert and Mauchly complete the Binary Automatic Computer (Binac) for Northrop Aircraft Co., making it one of the first operational stored-program computers.

MIT's Jay Forrester conceives the idea of organizing magnetic core computer memories, a notion developed by An Wang, into a grid or matrix, providing a far greater practical application than a serial connection.

1950

Von Neumann's EDVAC is finally complete. Having lost the distinction as the first stored-program computer, it is still the first to use binary or digital mathematics.

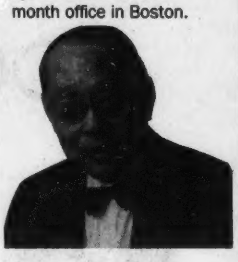
Kurt Vonnegut Jr. writes about "EPICAC" in one of the first computer love stories.

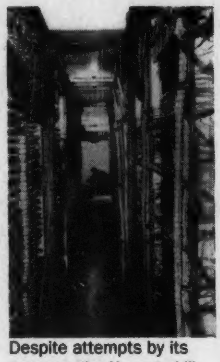
Remington-Rand Corp. buys the financially troubled Eckert-Mauchly Computer Corp.

1951

The Universal Automatic Computer, Univac I, made by Remington-Rand and operating at a rate of 2,000 computations a second, is delivered to the U.S. Bureau of the Census as the first American commercially produced computer.

Wang Laboratories, Inc. is founded by An Wang and family. The company starts in a $70-a-month office in Boston.





Despite attempts by its sponsor, the Navy, to kill the project, the Whirlwind computer is completed at MIT by Jay Forrester and Ken Olsen. The first 16-bit minicomputer, Whirlwind can perform calculations on data in parallel, inaugurating real-time computing.

1952

A major producer of punched cards, IBM adds the 701, its first electronic stored-program computer, to its product line.

Walter Cronkite touts Univac as that "marvelous electronic brain" during its television debut calculating presidential election returns. The machine predicts Eisenhower's victory just one hour after the polls close.

1953

The Universal Digital Electronic Computer (UDEC) is built by Burroughs Corp. and installed at Wayne State University.

IBM introduces the first magnetic tape device, the Model 726. It can pack 100 characters per inch and move at 75 inches per second.

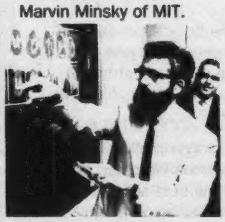
1954

The first commercially owned Univac I is delivered to General Electric Co.

Fortran, or Formula Translation programming language, is developed by John Bakus at IBM.

1956

The term "artificial intelligence" is coined by Dartmouth College Assistant Professor John McCarthy, who organizes the Dartmouth Conference in Hanover, N.H., with the help of Marvin Minsky of MIT.

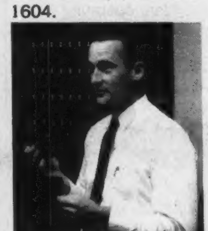


1957

Ken Olsen leaves MIT to start Digital Equipment Corp. with $70,000 in venture capital.

1958

Seymour Cray builds the first fully transistorized supercomputer for Control Data Corp., the CDC 1604.



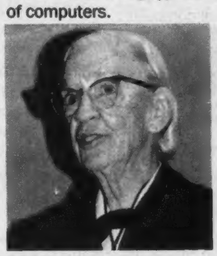
AN/FSQ-7, part of the Air Force's Semi-Automatic Ground Environment (SAGE), is completed. The largest computer ever built, it weighs 175 tons and is used for air defense.

Lisp, for List Processor, language is invented by MIT's John McCarthy for AI applications.

1959

Jack Kilby of Texas Instruments and Robert Noyce of Fairchild Semiconductor develop "the monolithic idea," creating the integrated circuit, a breakthrough that will allow the dream of smaller and more affordable computers to become a reality.

Cobol, for Commercial and Business-Oriented Language, based on Grace Hopper's Flow-Matic, is created by Codasyl, the Committee on Data Systems Languages. Hopper invents a compiler that makes Cobol run on many types of computers.



1960

The first modern computer generation ends as vacuum tubes, punched cards and machine codes give way to second-generation transistors, magnetic tape and procedural languages in computer design and operation.

1961

The first patient monitoring system is implemented at the National Health Institute Clinic in Maryland.

1962

Computer industry revenues reach the $1 billion mark.

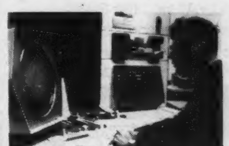
APL, for A Programming Language, is developed by Ken Iverson, Harvard University and IBM for modeling programs.

Dr. Edward Thorpe writes *Beat the Dealer* on using a computer to win at blackjack.

H. Ross Perot founds Electronic Data Systems Corp.

1963

CDC ships the first supercomputer using silicon transistors to Lawrence Livermore National Labs in California.



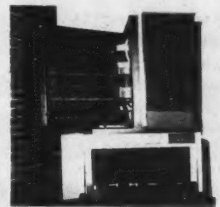
DEC launches the PDP-1, introducing the video display.

Eliza is designed by MIT's Joseph Weizenbaum as a program to simulate a psychotherapist's consultation session.

MIT doctoral candidate Ivan Sutherland designs Sketchpad, which allows users to make CRT drawings with a light pen, the forerunner of future graphic design systems.

1964

In the first computer crime involving criminal prosecution, *Texas* v. *Hancock*, a programmer who stole $5 million worth of his employer's software is convicted and sentenced to five years.



Costing less than $10,000 and operating from an ordinary power outlet, DEC's PDP-8 is introduced as the first commercial minicomputer.

IBM 360 computers are announced as the first modular, compatible series of general-purpose machines.

1965

Beginner's All-Purpose Symbolic Instruction Code (Basic) language is created by Tom Kurtz and John Kemeny of Dartmouth.

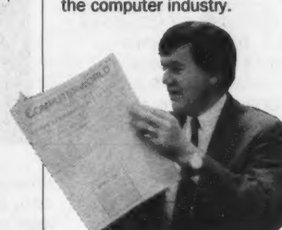
1966

Texas Instruments offers the first solid-state hand-held calculator.

Operation Match computer dating service opens in Cambridge, Mass.

1967

Pat McGovern launches *Computerworld*, a weekly newspaper geared to the computer industry.



The third generation is under way, with integrated circuits, floppy disks and nonprocedural languages becoming prominent in computer construction and usage.

1968

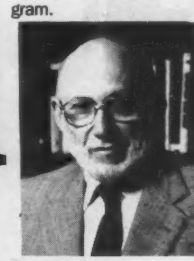
Gordon Moore and Robert Noyce found Integrated Electronics (Intel) Corp.

intel

The first mutinous computer, HAL, is introduced in *2001: A Space Odyssey*.

W. Carlos's "Switched-On Bach," an album of fugues and preludes played on a Moog synthesizer, becomes popular.

Joshua Lederberg and associates at Stanford University create Dendral, the first medical diagnostic computer program.



1969

The Intel 4004 becomes the first microprocessor.

Former DEC PDP-8 chief engineer Edson deCastro starts Data General Corp. DG introduces the first commercial 16-bit minicomputer, the Nova, just before DEC announces a 16-bit machine, the PDP-11/20.

1970

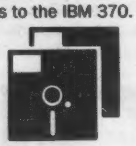
The first robot supermarket, Telemart, opens in San Diego. The idea was that shoppers would use their Touch-Tone phones to call into a computer that would help them select their groceries and have them delivered. The supermarket closes because so many shoppers call that the computer can't handle the orders.

Jack Myers and Harry Pople of the University of Pittsburgh create Internist, later called Caduceus, the most comprehensive medical diagnostic computer program, capable of identifying more than 500 diseases and 3,000 manifestations.

1971

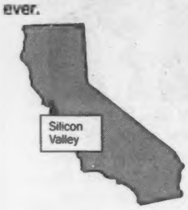
Intel markets the 4004 microprocessor, which paves the way for the micro revolution.

The floppy disk is introduced to feed instructions to the IBM 370.



Pascal, named after the famous mathematician, is developed by Niklaus Wirth of Switzerland as a programming language for systems development.

Journalist Don Hoefler refers to a 100-square-mile valley southeast of San Francisco as Silicon Valley because of the number of high-tech firms prospering there. The area's identity, once based on crops of plums, pears and prunes, is changed forever.



1972

Intel develops the 8008, an 8-bit microprocessor.

Atari scores big with its Pong video game.

Gary Kildall, a professor at the Naval Postgraduate School down the road from Silicon Valley, writes PL/I, the first programming language for the 4004 microprocessor.

1973

The National Computer Conference is held for the first time in New York.

John Atanasoff wins a U.S. District Court decision recognizing him as the official inventor of the computer after a lengthy patent trial involving Honeywell and Sperry-Rand.

Thi T. Troung, a Frenchman of Vietnamese origin, develops the first 8008-based microcomputer but is unsuccessful at selling it.

1974

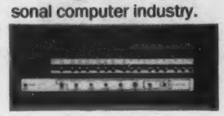
Radio Electronics magazine publishes an article on how to build the Mark 8 "your personal minicomputer" using an 8008 microprocessor.

Banks begin to experiment with automatic teller machines; First Federal Savings & Loan, in Nebraska, takes in 672 new accounts in six weeks.

Zilog, Inc. is founded by two leading designers from Intel to create the Z80 chip, competing directly with Intel's new 8080 microprocessor.

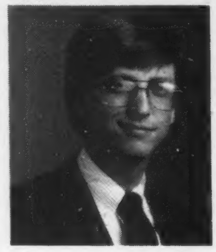
1975

Ed Roberts and Bill Yates of MIT design and market the Altair, the first personal computer. Named after a "Star Trek" episode, "A Voyage to Altair," the 8080-based microcomputer is the catalyst for the personal computer industry.



The Cray-1 supercomputer is introduced as the fastest computer on earth, performing a million more calculations per second than Eniac in a space a thousand times smaller.

Microsoft Corp. is founded by Bill Gates and Paul Allen after they adapt Basic to the Altair microcomputer.



1976

The Social Security Administration's five-acre computer complex, dedicated to record keeping, sets records of its own with more than half the budget for the Aid For Dependent Children program administration being spent to pay for computer errors.

digital

PRIME

Superminicomputers are introduced by Perkin-Elmer and Gould SEL, followed shortly by DEC's VAX-11/780 and Prime Computer's 750.

Tandem introduces the first fault-tolerant computer, the T/16.

1977

Apple Computer, founded by Steve Wozniak and Steve Jobs, introduces the Apple II personal computer.

Radio Shack unveils its first TRS-80 microcomputer.

The first Computerland franchise store opens in Morristown, N.J., under the name Computer-shack.

Orginally developed for computerized astrology by Gary Kildall, CP/M is marketed by Digital Research as a standard control program for personal computers.

1978

Dan Bricklin and Bob Frankston create Visicalc, electronic spreadsheet software.

Texas Instruments offers a speak-and-spell toy featuring digital speech.

1979

The Source, an electronic service, begins offering news and stock reports to home computer owners.

Micropro International releases Wordstar, one of the best-selling word processing programs.

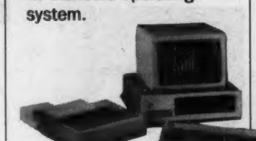
1980

Shugart Associates introduces the Winchester disk drive, which stores 30 times more data than a small floppy.

CDC introduces the Cyber 205 to match the performance of Cray's creations.

1981

The IBM Personal Computer debuts, and Microsoft's MS-DOS becomes its standard operating system.



The personal computer industry passes the $1.5 billion mark.

The first computer wedding is performed by Rev. Ron Jaenisch using an Apple personal computer in California. The computer displays the text of the ceremony on screen, and the bride and groom indicate their "I do's" by pressing the "Y" key.

"Factory Robot Kills Worker" reads the headline about the first reported death caused by a robot: Kenji Urada, 37, is killed when a self-propelled robot cart in a Japanese factory runs him over as he tries to repair it.

Osborne Computer introduces the Osborne 1, the first portable computer.

Home computers are inaugurated by the introduction of the Commodore VIC-20, which sells more than one million units.

1982

A computer, in Washington, D.C., is used to help Nan Davis, a paraplegic, walk.

TIME

Time magazine names the computer its "Man of the Year."

Jimmy Carter is the first president to use a word processor to write his memoirs.

Walt Disney Studios makes *Tron*, a movie whose main characters live inside a computer.

1983

There are 13 million computers in the world.

Lotus's 1-2-3 takes Visicalc's place as the popular spreadsheet program marketed by company founder Mitch Kapor.

Computer industry revenues reach $55 billion, $2.4 billion of it in personal computer sales.

More than 4.5 million U.S. students, mostly high school age, use computers in public schools.

Test versions of a biological microchip are produced by EMV Associates, a Maryland biotechnology company.

Radio Shack
COMPUTER CENTERS

Radio Shack offers a book-size computer, the Model 100.

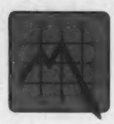
Osborne Computer declares bankruptcy. Texas Instruments and Timex Corp. sell off computer businesses.

Software sales reach the $1 billion mark, growing at 50% a year.

Hewlett-Packard offers the first touch-screen personal computer, the HP-150.

1984

Sales of home computers priced below $1,000 fall 30% from 1983 levels.



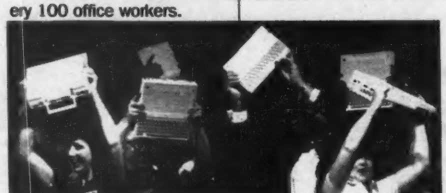
Magazines targeted to computerphiles number 450, the largest ever devoted to a single subject.

1985

Technological trends and innovations include the use of IBM PC-DOS and Unix operating systems as standards, the start-up of fault-tolerant computer firms and the invention of the one-million-bit random-access memory chip.

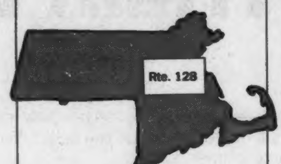
UNIX

The number of personal computers used in offices in the U.S. rises to nine million, with an estimated 15.6 PCs for every 100 office workers.

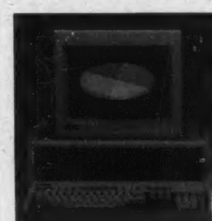


1986

Computerworld publishes its 1,000th issue on Nov. 3 with a special section celebrating the computer age.



A state in search of a slogan, Massachusetts takes advantage of the large number of high-tech firms along Route 128 and declares itself the Software Capital of the country.



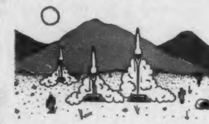
Winning the race, Compaq Computer Corp. releases the Deskpro 386, the first personal computer to use Intel's most advanced microprocessor, the 80386. The chip offers 130 megabytes of disk storage and an average access time of 19 milliseconds.

1988

Computers containing a million processors will be set to work solving complex problems.

1989

Cambridge, Mass., firm Bolt, Beranek, and Newman, Inc. expects to complete the Monarch computer, which is planned to perform eight million floating point operations per second (MFLOPS). The parallel processing computer is to be used by the U.S. Department of Defense.



1990

The advent of parallel processing and greatly increased processing power is expected to make this truly the year of artificial intelligence.

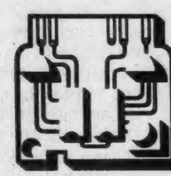
IBM

IBM expects to reach the $100 billion mark in revenue.

The number of personal computers used by U.S. businesses is expected to increase to 24.5 million.

2000

Experts predict that computers containing a billion processors will be technologically feasible, exceeding the power of the human brain.



The electronics industry is expected to be a $900 billion-a-year business, second only to agriculture in the world economy.

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COMPUTERS AND SOCIETY

What humans will never need computers to do

BY ISAAC ASIMOV

If we look into a peaceful future in which humanity manages to keep from destroying itself, it seems certain that computers will continue to develop and become more capable and versatile. Yet it is risky to offer to predict what a computer *can't* do, for one is far too likely to be wrong.

Arthur C. Clarke's most quotable comment is this: "When a distinguished, but elderly, scientist says that something is impossible, he is probably wrong."

My distinction is perhaps debatable, but I am as elderly as anybody, and I take that statement to heart. However, I am perfectly willing to predict what a computer *won't* do, even if it could. But perhaps I should rephrase that and say that I am willing to predict what a computer won't be designed to do, even if the design is possible.

To see the difference between can't and won't, consider the automobile. It speeds along on wheels, which in turn spin on axles.

The wheel and axle is the first invention human beings made that outdid nature, for no living organism progresses by means of wheels and axles. These features may, in fact, be impossible in organisms because of the difficulty of arranging a circulatory and nervous system to nourish and control a living, turning wheel.

The result is that while the automobile speeds along, we human beings are condemned to trudge — clumping along by lifting first one foot, then the other.

And yet walking — up, down, up, down — has its advantages. Wheels need a reasonably smooth surface, whereas in walking, we can step over small obstructions and clamber over large ones. We can walk in underbrush, along narrow trails, sidle along precarious footholds while holding to a cliff side. These feats may not be as impressive as 60 miles per hour on a smooth highway, but if you couldn't do them, you would feel the restriction.

I imagine that it is possible to invent a mechanical device that would lift feet rather than turn wheels. If as much energy and ingenuity were put into such a walking machine as has been put into the rolling machine, I dare say we could have very nice walk-mobiles. You could get into one and go walking along a rocky road, up a country lane, over rocks and along cliff sides.

But who on earth would bother to design such a machine? Who would spend large sums of money in order to produce something that human beings could do easily for themselves? Granted, walking can be tiresome, but at least it can be done for free. To get into an undoubtedly expensive machine and to have to put out money for fuel and for repairs in order to walk mechanically is a kind of conspicuous consumption that would appeal only to psychotics. As a matter of fact, society has proven much more willing to build an incredibly expensive network of highways in order to make the automobile wheel useful than it would be likely to spend on walk-mobiles that might make highways unnecessary.

In short, then, automobiles are designed to do what human beings, without them, cannot do, or can do only with great difficulty. They are not designed, and never would be designed, to do what human beings could do easily and naturally without them.

How does that apply to computers?

We are most familiar with computers solving mathematical problems — carrying out arithmetic operations at great speed and with almost zero chance of inaccuracy.

This is certainly something human beings cannot do. The human brain, while capable of working out mathematical problems, does so very slowly and tediously and with a distressing aptitude for arithmetic or logical errors. Therefore, we welcome computers in this respect, and we labor to design them to work on such things faster and faster and try to make them capable of tackling problems of ever greater complexity.

And why not? We don't need an automobile to go from New York to Chicago. We could walk the distance — but it would take us a great deal of time and effort. Better to use an automobile and design highways and signs and turnoffs and more economical engines to do the job even better.

We are not abandoning anything vital in turning mathematical operations over to a computer. We are merely exchanging an older, less efficient tool for a newer, more efficient one.

It is a mistake to think that allowing computers to solve problems dehumanizes a human being and that before the computer, human beings proudly solved problems by themselves. Not so.

The ordinary human being, even if reasonably intelligent and thoroughly educated, can scarcely do anything in mathematics on his own. If you don't believe that and consider yourself intelligent and educated, then divide 72,647 by 323 to three decimal places — in your head. I doubt that you'll even try (I wouldn't), and you might even walk from New York to Chicago in less time than it would take for you to get the right answer. And yet that is an extremely simple problem.

All through history, we have solved even the simplest mathematical problems with help — with our fingers, with pen and paper following memorized rules, with an abacus and slide rules and mechanical calculators. And now we have the computer, which is better than any of them.

Anything for which we can work out clear and complete instructions and that human beings can do only with difficulty, if at all, will be handed over to the computer, and rightly so.

What about things, though, that human beings can do easily and, yet, for which it is extremely difficult to work out clear and complete instructions?

Here is a borderline case — chess.

Chess is played with 32 pieces of six different types on a board containing 64 squares in an eight-by-eight array. Every different chessman has a particular position at the start and can move only in certain simple ways. All the rules can be written out, and yet, despite years of effort, no chess-playing computer can match

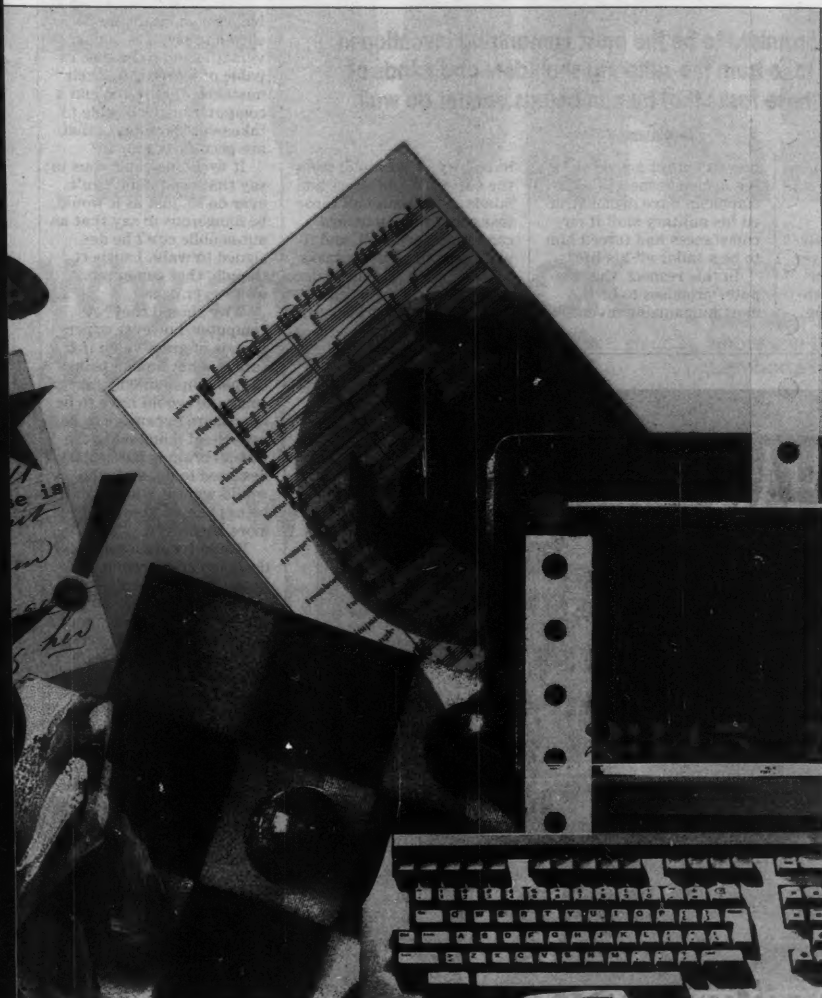


ILLUSTRATION BY KAREN WATSON

a grand master. A computer cannot beat Karpov or Kasparov, let alone Bobby Fischer. It may some day, but it can't yet.

Why is that? Well, despite the fixed and simple starting positions and rules of movement on a small board, the total number of possible positions and movements is unbelievably enormous, and we still can't get a computer to check all the possibilities in a reasonable time.

But, then, how do the chess masters do it? Ah, there you have the problem. We don't know! What's more, the chess masters don't know.

What if you take a more complicated game? The English language includes hundreds of thousands of words, and it may be that I have at my easy command 10,000 to 20,000 of them. I have, then, thousands of words instead of a few chessmen, and the words can be put together according to rules that are enormously more complicated than the rules governing chess moves. How about the game, then, of writing a story or an essay?

We all know the same words (assuming we are English speaking), we all know the rules of combination well enough, and we have all read stories and essays often, so we know what the finished product looks like. And yet few of us would even try to write a story or essay with the hope of having it printed. Of those who do make the effort, few can get an editor to agree that the result is publishable.

And yet I can do it. I have written, and published, quite literally thousands of stories and essays, and I have further published, so far, 349 books. There is only one way in which I can turn out this volume of material — and that is by writing as quickly as I can and getting it nearly right the first time. I do very little revising.

There is, you can well imagine, very little time for me to think, and any thinking I do manage to do has to be done very quickly.

Well, then, how do I do it? The answer is simple: I don't know how I do it. I haven't the faintest idea. I only know I have been able to do it since my teenage years, without being taught in any way.

In this I am not particularly remarkable. A great many people can do things that are extremely unusual. Who taught Mozart how to write symphonies? Who taught Louis Armstrong how to play the trumpet? Who taught Willie Mays how to catch a fly ball? Any human with a normal brain can do something or other very well and might not be able to explain how he does it.

That is the glory of the human brain — it can do things for which we are not yet able to write the rules. It may not be much good at mathematical operations or at graphic visualization, but it has what we might call creativity, intuition, insight, fantasy, imagination. It can consider a problem in which the data presented is insufficient for a certain conclusion, and yet, it can guess, or feel, or intuit what the right answer ought to be. This is done all the time in business, in administration, in science, in literature, in art.

You might argue that this sort of creativity, this instinctive ability, this talent — or even genius, if you will — is confined to a very small fraction of the population. It certainly seems to

HANDS-ON

. . . a poem as lovely as a PC

Can a poem be a poem if it is composed without reference to any feelings? How much meaning is implicit in structure? What are the source programs that govern a writer's use of language?

These are just a few of the thorny philosophical, literary and technical issues up for discussion in a course taught for the last few years at Allegheny College in Meadville, Pa. The course, called "Basic Poetry: The Computer as Poet," has been jointly administered by Alfred Kern, a professor in the department of English, and Jim Sheridan, professor of philosophy. The two are also long-time collaborators in an effort to program an IBM Personal Computer to write poetry that is not only technically correct but lucid and moving.

Kern and Sheridan reached a point in their project where the computer was knowledgeable enough about verse forms, alliteration, assonance and rhyme as well as the syllabic weight and part-of-speech functions of all the words in its dictionary that it could produce a reasonable facsimile of poetry upon demand. They then decided to share some of their findings in the classroom.

Students learned about artificial intelligence, grammar, poetic structure and the nature of inspiration. While all emerged having written some poetry of their own, Kern says, a few even progressed far enough in understanding the forms and functions of language to actually produce a poetry-generating program. However, the course was primarily designed to display the inner logic of language forms to a generation of students who reach college with one sentence structure to their name, which they use for all occasions. "We used the computer to show them the marvelous variations in construction that are possible," Kern says.

Kern, who is a poet and novelist himself, finds inspiration for his own work in some of the bold imagery spewed out by the computer, which has not yet been programmed to think in conventional terms and is capable of random linkings of words that are sometimes shockingly evocative. "Sometimes," Kern says, "it will come up with phrases that are as inspirational as a goodnight kiss or a walk in the woods, and you say to yourself, 'I've got to find a way to use that.' "

That was the case with a number of random phrases produced by the computer using an advanced version of Kern and Sheridan's program that was written for them by colleague Richard Bevins, a physical chemist.

The computer produced these lines:

You do remain autumn before any session
Unless shock gain coldly lemon autumn
You can silence during half silence
Despite silence freeze loosely accountable moment
For who would write than last sun
Herself count countless body
But who holds then mad tomb
Or who arrange unsure light
Provided marble teach adrift finite force

Although hardly poetry in and of themselves, fragments of these lines and images did provide raw data for a Kern creation called "Second Law":

For who, then, would write of the last sun?
Who would gain the shock of that coldly lemon autumn,
Arrange the unsure light to chart the chartless night,
Mute marble's shout to declare all death to tombs,
Freeze loud silence fast in the one accountable moment
And fight to win the finite fight of peace with peace?

Kerns calls this poem a collaborative effort.

The computer promises to be the most humanizing invention in history. It will take from the suffering shoulders and minds of humanity all those tasks that human beings cannot do well.

be so confined, but is that a true situation or only the result of the kind of life we live? Because we have spent all but a short period of human history without advanced technology of any kind, most human beings have been forced to spend their lives at work that does not significantly utilize the brain.

They have had to do unskilled muscle work, they have had to do trivial mental work, they have had to work at tedious occupations for which the brain is not suited — adding up columns of figures, for instance.

Only the tiniest fraction of human beings have ever been in a position to exercise their creativity. Without exercise of something, do you expect a good showing in that respect? Could Napolean have demonstrated his military skill if circumstances had forced him to be a tailor all his life?

In this respect, the computer promises to be the most humanizing invention in history. It will take from the suffering shoulders and minds of humanity all those tasks that human beings cannot do very well, and it will leave them those tasks for which the human brain is particularly designed.

But might it not be possible, as computers are designed to be more and more versatile and to become capable of learning by their mistakes, that in the end a computer might be able to take over those tasks that are peculiarly human?

It would be dangerous to say that computers *can't* ever do so, just as it would be dangerous to say that an automobile *can't* be designed to walk. I suspect, though, that computers *won't* ever do so.

Why should they? A computer, however expensive, is of great value if it can do what human beings cannot. Undoubtedly, a computer would have to be even more expensive to be capable of doing what the human brain is particularly designed to do, and who would want it when human beings can do it so much more cheaply?

Would I want a computer designed at enormous expense simply in order to have it write stories and essays for me, when I am capable of writing them so easily for myself, using no more than pen and ink, if I have to? Would anyone?

Computers may be a tool to help me do the writing. But I do the thinking just as much with the word processor as with pen and ink. There would be no more sense in having a computer think for me than there would be to have an automobile walk for me. Especially since I enjoy thinking much more than I enjoy walking.

Here, then, is my rule for the future:

Computers probably can be designed, and probably *will* be designed, to do anything that the human brain finds difficult or tedious to do.

Computers probably can be designed, but almost certainly *won't* be designed, to do anything that the human brain finds easy or pleasurable to do.

....

> “*Computers are simply a necessary and enjoyable part of life, like food and books. Computers are not everything, they are just an aspect of everything, and not to know this is computer illiteracy, a silly dangerous ignorance.*”
>
> **THEODOR NELSON** from *Computer Lib*

Joshua Lederberg

Tying minds together to advance science and social intelligence

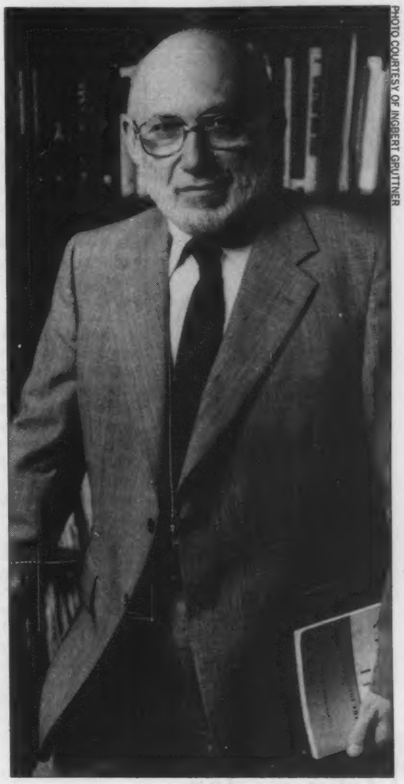


PHOTO COURTESY OF INGBERT GRUTTNER

Nobel Prize-winning geneticist Joshua Lederberg developed the expert system, Dendral, with Edward Feigenbaum while at Stanford University in the early '60s. Dendral, the first applied use of artificial intelligence, interprets data produced by mass spectrometers to determine molecular structures of unknown compounds.

For the past eight years, Lederberg has been president of Rockefeller University, a New York City-based biomedical research institution founded in 1901 as the Rockefeller Institute for Medical Research.

Lederberg spoke recently with Computerworld *Senior Editor Janet Fiderio about the impact computers continue to make on education and society.*

What role do computers now play in education? Have they changed the way we educate students?

LEDERBERG: From the research side and from the uses of computers in science, there is, of course, a very strong tradition in the indispensability of computers in data analysis; the direct connection with laboratory experimentation is well known.

But what has been perhaps a greater interest to me — and this is the thread that goes through the work I did with Ed Feigenbaum at Stanford — is the use of the computer in the communications network as the technical support for improving the social system of scientific advance. It's a way in which minds can be brought together more effectively and make an effective use of the expertise that's present elsewhere.

An expert system should be thought as much a social device as a technical instrument. It is a way the expertise that is resident in the minds of individuals can be more effectively stored, manipulated, corrected, updated and brought to bear on a range of problems, and that's really the point where I would place the greatest emphasis. It's a way of developing social intelligence.

So expert systems as social devices spur creativity?

LEDEkBERG: They will allow you to be at the state of the art. If you have authentically acquired the expertise that is available on the subject, you know you're not reinventing what they're doing; you have authentic, well-crafted statements.

An expert system is not that different from a library, but it's a way of mechanizing that library so it can be operationally effective and much more efficiently managed. It also is an enormous discipline.

One of the most exciting aspects of expert systems is the discipline it puts on the experts who are providing the background. One of the things that slows the work in this field is when you're putting together your production rules and so on, you discover there were inconsistencies in what you put in. It's better found at that logical level than when the bridge collapses.

You might call that criticism rather than creativity, but I think we have to keep in mind that with any scientific advance or cultural one, that these two have to be kept hand-in-hand. We need a lot of imagination, and it has to be checked by criticism. Criticism is the authenticity to self consistency. It checks that you said what you meant because the program is going to implement what you said. I think it speeds up the process of putting creative ideas to bear.

Where will we see the greatest potential for expert systems in society — medicine, research?

LEDERBERG: Anywhere there is a library, and anywhere there isn't a library and there should be, such as when the expertise is informal and not that well codified. Expert systems are a way of writing expertise down and getting at the experts before they disappear. *Chemical Week* magazine recently published a piece on expert systems in factory management. In one firm, the chemical engineers were retiring and they didn't know how they would bring up the skills of the new people to that level. They did a very wise thing — before those people left, they tried to dump their memories into an expert system and wrote down many operating rules that had never been written down before.

I wouldn't single out one area for expert system use. And the last thing in the world I would do would be to replace positions by a machine — no more than I would replace them by a few books on the shelf. I do think, however, that for providing support in the decision-making process, wherever consequential decisions rely on knowledge and expertise, we can greatly enhance that with machine systems.

Will we forget the basics of education due to expert systems? Will we become too dependent on them?

LEDERBERG: I suppose the first person who came along with a book would ask the same question: Are we going to be too reliant on this stuff written down and forget to remember stuff that we get through the oral tradition?

Of course, there is a danger, but I would say there is no other way to manage the enormous expansion of knowledge, no other way to counter the trap that we have laid for ourselves — the trap that goes under the label of specialization — without this kind of help.

Look where we are now. Knowledge in general is much too complicated. We have poor communications with colleagues in other fields. That's not a very satisfactory situation; we have systemic errors that come out of inadequate communication. You can find it every day in the practice of medicine.

What problems remain for you to investigate?

LEDERBERG: There are still some very hard problems that we never quite tackled, but I think our efforts would have been premature for some of the reasons given here. There are severe hardware limitations even now, which hurt effectively getting into things like learning systems, which is the next horizon.

We've had a little start at that, a thing called Medidendral, but the hardware just isn't up to it yet.

What are Medidendral and learning systems?

It's a way expertise can be learned by a system by looking at raw data from the outside world. Learning by experience is what I'm trying to say.

The first stage of expert systems is to learn from experts. You ask yourself how the experts learn, and a great deal of that is intellectual, learning from other experts.

But some of it, new knowledge, is gotten by experience. This part includes laboratory experiment or other sorts of data, the induction of hypothesis that can fit those data and the

establishing of rules, the governing laws, the generalizations, the hypotheses and theories of science.

I would like to be able to move to that next step and find systems that learn the way we learn.

So, basically, the structure of learning systems needs to be addressed as a mathematical problem and as a hardware problem.

And second, the social system, the use of expert systems . . . there is a way of thinking about them that needs to be understood very carefully.

Knowing what you do about the shortcomings of expert systems and other computerized systems in use throughout society, does it ever concern you that computers control nuclear power facilities and nuclear bombs?

LEDERBERG: No more nervous than any complex social system. If you don't have a computer in there, you'll have some other dimwit pushing the buttons.

It's the complexity in the system, not the machine, that's driving it, that leads us to these frustrations. I think we need to have a realistic approach to the capabilities of what these nodes are.

One needs to understand the limitations thoroughly, but one also has to ask what the alternative is. There is no panacea.

If it's not one evil, it's another?

LEDERBERG: Yes. And I think, best of all, there's some balance where there's the possiblity of human invention. . . . I think a cross-check with a larger set of expertise. It's involved in human judgment and communication with other individuals and so on.

In a world with five billion, and one billion in a very advanced stage of technological and economic organization, I think that's where the problem is.

What about the question of retaining personal privacy?

LEDERBERG: I don't think we can live in a complex society and have the efficiency of transactions without sacrificing privacy. The underlying problem is that you want to have credit, you want to be able to go to far away places and have them recognize you instantly as someone who is credit-worthy. Of course, you're going to have to sacrifice something to make that possible.

We do need to maintain the integrity of the credit checking system and understand that there can be mistakes in it. We want to lean over backwards to make sure of that.

I am talking about balancing efficiency wth justice, and one of the things computer systems can do is bring the cost of manuipulating a great deal of data on people down to a level where there may be a temptation to not complicate the system again by adding those costs that are necessary to protect individual rights, such as the right of appeal when there is something in the credit system that doesn't belong there.

But I think we're going to have to face up to the fact that a world with five billion people doesn't have much latitude for privacy, and we'll have to be asking ourselves is it really so important that we would be willing to give up other values?

Of course, there is no answer to that question. For the most part, I think the questions about privacy are inordinate. I don't see the actuality of abuse as much as people's fears of it.

Expert systems are a way of writing expertise down and getting at the experts before they disappear.

And it's a political decision, not a technological one, what abuse might be made.

You have information that's in the hands of a political authority, and it can be used to blackmail people, suppress dissidents and so forth, of course that's quite an abuse.

But I think there is the issue in that political issue — what the rights of individuals are, not about what their privacy is in the first place, but what abuse is made on information.

I would advocate to most people that they just learn to live with the fact that private affairs are going to be more transparent, and they always have been if you get right down to it.

There's a change of dimension with a broad range of people having access, but that also means you have a better opportunity to divide your correctives. I would come back and add that if you try to tally up all the abuses of privacy there have been in this snoopy society, I don't think they add up to a hill of beans. But people are worried about it.

Why do you think there are people out there who are still afraid of computers?

LEDERBERG: I think their real anger and anxiety is about the complexity of the social system. The computer is emblematic of it, it's a major instrument of social administration, and that is a constraint on freedom to have to share your living space with five billion others. But there it is.

The understanding of the role of computer-based communications systems is a way in which people can work together more effectively. We should be keeping our eyes on the objectives in computer advancement.

COMMENT

Forecasting 100 years in the future is a relatively low-risk proposition, since those who read my predictions in 1986 are unlikely to be around to critique them in 2086.

Few can disagree that the ultimate social impact of computers will be tremendous. Many exciting advances in computer technology are already within grasp or seem just around the corner — advances that challenge the imagination and that are bound to drive fundamental changes in human endeavor.

Consider the possibilities presented by future advances in artificial intelligence, "thinking" robots, portable personal terminals, huge data bases, even human-implantable computer chips. Individually or in combination, these and other technological marvels suggest a thousand fascinating scenarios.

For example, will society in 2086 see these marvels?

- Robots handling routine personal chores and performing dangerous or unhealthy manual labor tasks.
- Credit-card-size terminals that allow people to conduct most of their personal business transactions any time, any place.
- Human memory assisted by an implanted memory chip.
- Computers so advanced they will develop their own understanding and logic and utilize sensors to interact with their environment just as humans do.

I think these and many other applications of computer technology may very well exist before the next century ends. As a result, individuals will certainly have more leisure time. The question is, how will they use it? Again, the possible scenarios are limited only by the imagination.

New art forms will develop as people find unique ways of stimulating the senses. Entertainment will be revolutionized as viewers or spectators become part of the event itself.

Learning will become a permanent part of everyday life. With vast amounts of knowledge at their disposal, people must find new ways to learn and think.

Computers will allow modeling and experimenting to take place in ways that can avoid both physical disasters and social confrontations.

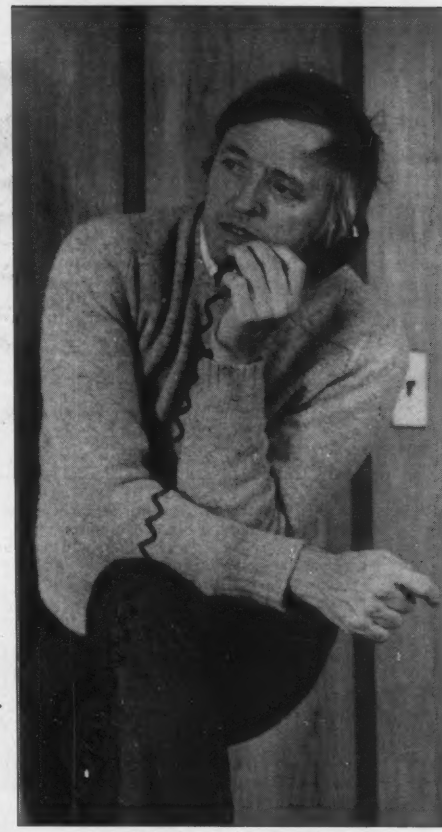
Computers in the workplace will contribute to the increase in leisure time. They also will change the very nature of jobs, and individuals will face a restructuring of their daily routines and the work environment.

I believe we can anticipate an exhilarating and fascinating future, thanks, at least in part, to the many wonderful possibilities offered by computers. By preparing now to make appropriate choices, we can help exploit the potential of technology to stimulate and enhance the lives of future generations.

CHARLES EXLEY JR.
Chairman, NCR Corp.

Conservatives, collectivization, computers and originality

Computer technology is an enhancement of individuation, not its oppressor



BY WILLIAM F. BUCKLEY JR.
Editor, National Review

As a political conservative presumptively opposed to collectivization, I am sent many unfriendly references to computer technology, some of them even mutinous in inclination. One correspondent suggested that I urge all recipients of IRS forms of the kind that arrive with little slits in them made, clearly, to oblige computers, to pull out a pair of scissors and neatly incise two or three extra slits in order to bollix up the system.

Though attracted to mischief of any sort, not least when at the expense of the Internal Revenue Service, I have resisted these injunctions by my brothers to take the Luddite road, and I take the opportunity, on the 40th birthday of the computer, to make a point underappreciated by my fellow conservatives. It is quite simply this: Computer technology is an enhancement of individuation, not its oppressor. And this statement I make on the confident grounds that just as no two fingerprints are identical, so no two computer numbers, designating different individuals, can expect to be identical while still serving any purpose whatever.

In a public argument I had with Prof. John Kenneth Galbraith a few years ago, he contended that the advance of the computer required great social protections from the state. I insisted that the opposite was the case, that the individual's protections were being heightened, even in the commercial world.

I observed that any advance in technology, the end of which would be to further individual interests and to serve individual tastes, ought to be welcomed by conservatives. Because of computer technology, one ascertains more quickly than before whether this or that projected development attracts favorable or unfavorable attention in the marketplace. It is highly unlikely that such historical monstrosities as the Edsel car would have been launched if there had been available at the time the marketing technology we have today. Individual reactions, measured in bytes rather than in millions, would have returned to the manufacturer the fatal sniff of disdain . . . The sensitive entrepreneur would quickly have gone into reverse gear, aborting that aesthetic disfiguration we all love to hate.

The argument carries forward to the question of individual identification codes. This is a great crusade among many conservatives: *They shall not give us identifying numbers!*

Well, in the first place, "they" have already done so; we all carry Social Security numbers. But the point, surely, is, How do we explain the argument that individuation results in collectivization? Isn't it the other way around? If, at birth, I am assigned the number 34,933,643 (which happens to have been my serial number when I was drafted), in what way is that a threat to my liberty?

We know that computer technology is a great aid to merchandisers, who think about customers in intersecting units (over 40 years old, under 150 pounds in weight, lives east of the Hudson, reared west of the Mississippi, one spouse, one lover, reads 1.5 books per year . . .), but is it alarming to know that computer technology stores up more statistics about us than are known to our mother? Still, I say, so what?

I once received a letter that began, "Dear Mr. Buckley," went on to recite the awful legal ordeal of the patriotic William F. Buckley Jr. in his fight against compulsory unionism and went on to ask for "a minimum of $10" to help with legal defense. The letter was signed, "Your fellow believer in individual liberty, William F. Buckley Jr."

So? These things happen. But the appeal in question, which raised a few thousand dollars, might not have raised a few thousand dollars if we had not been efficiently submissive to computer technology.

And if, in what is left of my biblical claim to three score and 10 years on earth, I receive one, maybe even two, more letters, written by me, about me and addressed to me, I shall weather the depersonalizations of the computer age with all due calm, satisfied that the text of any letter signed by me will be appropriately complimentary about me. Provided the text is properly complimentary.

'Did you hear the one about the human who . . .'

Our belongings may begin talking among themselves even when we are not present

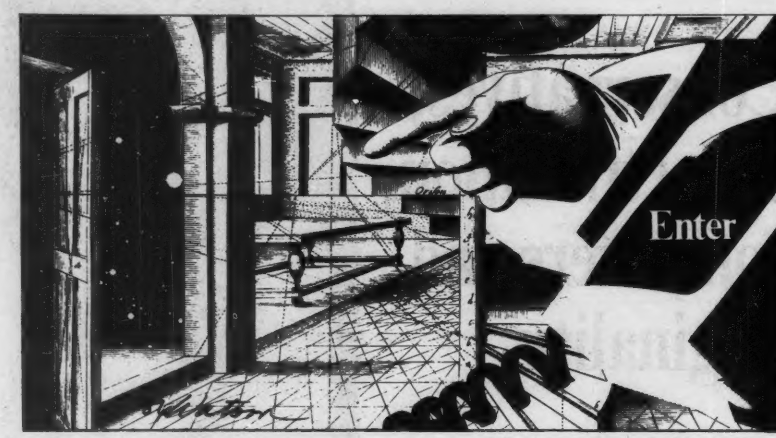


ILLUSTRATION BY KAREN WATSON

BY EDWARD CORNISH
President, World Future Society

The computerized homes of the future may have more "smarts" than the people living in them. But the people won't mind, because all of the electronic intelligence will be devoted to making them happier. Computers in our homes will do all kinds of things to make us comfortable, safe and well informed. They will also help to feed and entertain us — and perhaps even give us our baths.

Our homes will talk to us, of course, thanks to voice synthesis and recognition systems. If a heat-detection device senses a possible fire, it will activate a microprocessor controlling a voice-production system, which will shout "FIRE!" Then, having gotten our attention, it will give us a report: "The fire detector in the attic reports a possible fire. Please check at once. Unless countermanding response is given immediately, I shall alert the fire department."

Furniture will also talk to us. You may find that your dining room table talks better than some of your guests! It may not say much more than things like, "Are somebody's elbows leaning on me?" But you could program it to tell witty stories whenever the conversation gets dull.

You can't get a talking table at your furniture store yet, but your automobile dealer may sell you a talking car that says things like, "Fasten your seat belt." Since the basic technology of speech synthesis is already here, it's only a matter of time before we have talking furniture.

Furniture manufacturers have not rushed to give their products the power of speech, because the furniture business moves more slowly than the automobile and electronics industries. Automobiles wear out after a decade or so, but people may dine off the same table for centuries.

Still, furniture will eventually incorporate computers, and tables and chairs won't just talk. They will also listen. Chairs will move by themselves at your command. For this development, we will probably owe a big debt to handicapped people.

Researchers are now developing furniture and equipment that will enable people with medical problems to do things for themselves. That will mean that many more of them will be able to live at home and not have to be hospitalized or given constant nursing care.

If you are too weak to walk to the bathroom, a robot wheelchair might enable you to make the trip without assistance. You shout a code word to get your automated wheelchair's attention, then give a command. It might go like this:

"MORTIMER, FORWARD!"

Mortimer rolls slowly forward.

"MORTIMER, STOP. LEFT FACE. FORWARD . . . STOP."

When Mortimer has stopped beside your bed, you get on board for your trip to the bathroom. Later, Mortimer brings you back. Unlike a human helper, Mortimer is always available.

Voice-command robotic tables are also under development so that bedridden people can command a table to move toward them so they can get a drink or write a letter.

The enormous cost of caring for people in hospitals and nursing homes means that voice-commandable tables and chairs can be justifiable investments for the handicapped — and that means there is a big market waiting for robotic furniture manufacturers. As robotic furniture products are perfected and prices come down, people without handicaps will decide it's nice to have tables and chairs that obey their commands.

Say you have a little difficulty getting up in the morning. Wouldn't it be luxurious to have yourself gently lifted out of bed, placed in a tub and given a pleasant whirlpool bath to help get you ready for the day? A Japanese company (Sanyo Electric) some years ago developed a "people washer" that looked like a huge egg. People would climb into it and go through a cycle of ultrasonic sound waves, bubbly water and warm air. Now researchers are aiming at robots that can lift you out of bed and put you into a bath or people washer.

Looming ahead is luxurious living beyond anything any emperor ever enjoyed: Computers and robots will wake us gently in the morning, perhaps by playing our favorite music, give us news reports in our areas of special interest, bathe and shave us, feed us breakfast, brush our teeth, comb or brush our hair and even dress us.

The computers and robots will talk to each other, of course.

A floor-cleaning robot may ask a sofa to move so it can clean under it. "Sofa, move!" After the robot is finished, it might say, "Sofa, back!"

The sofa and floor cleaner are both robots, and that illustrates several important points about the household robots of the future. Many people envision household robots as looking like mechanical people. But it is absurd to imitate human beings when designing robots. The history of progress is based on creating machines that have specialized capabilities surpassing those of human beings.

So household robots will come in a variety of forms, and only a few will be designed to look like humans: for instance, robot servants to offer drinks at parties and teaching robots for small children.

A robot that cleans rugs will be designed to excel at that task and perhaps a few others. It will be able to perform that task far better than a human servant — or a robot made like a human being. Other robots will be designed for other sorts of tasks. In short, our future homes will have lots of different kinds of robots — not one or two all-purpose models.

As computers enter our furniture, it will become more mobile and more intelligent — in other words, more like robots. A sofa that can respond to a command to move is no longer just dead wood, cloth and stuffing material; it has become quasi-animate.

A sofa that can respond to a command is not just dead wood, cloth and stuffing; it has become quasi-animate.

And when our belongings begin talking among themselves even when we are not present, we may begin to experience our homes in a very different way. We will feel surrounded by mechanical friends waiting to obey our every wish like perfectly trained, extraordinarily capable servants.

Presiding over your servants will, perhaps, be a robot butler, whom you might call Jeeves. It would be able to listen to your instructions and then rush about the house barking orders to the other robots. Speaking to Jeeves, you would probably use what may come to be called "robot English" — a simplified, almost grammarless version of standard English.

"Jeeves, go closet. Say, 'Blue suit.' Take blue suit, Return here."

"Order accepted," says Jeeves.

The robot slinks away. Like other command robots, it looks like a huge mechanical spider because it is designed to move in all directions, pick up objects of all shapes, push buttons, pull handles and perform any number of other tasks.

Jeeves soon returns with the suit. The

task was simple because the closet was roboticized and responsive to voice commands: Any item could be produced automatically upon request.

"Jeeves, welcome guest."

"Order accepted." Jeeves rushes about, carrying out a series of instructions designed to prepare your home for a human guest. Jeeves might alert the robot guards, which otherwise would refuse to let him pass and designate a humanoid robot to stand at the door to check the visitor's identity and welcome him to the house.

You may also check your home's central computer to make sure that everything is properly arranged for your guest's arrival. The computer will monitor your lighting system, turning lights on when someone is about to enter the room and off when he leaves; different colors may be used depending on your mood and the image you want to create for your visitor.

Video screens with computerized art will provide constantly changing scenes. You can instantly switch all your video art from scenes of the Netherlands to ocean scenes. The computer can also order the fragrance player to generate the appropriate aromas, such as tulips or a salty ocean breeze.

'Electronic womb'

Our future homes will be so pleasant that we won't want to leave them much. In fact, social pundits may worry around the "electronic womb" into which everyone seems to have retreated. We may do more of our shopping from home, visiting shops electronically without having to travel to them.

The microcomputers now entering U.S. homes in great numbers are being linked up into far-flung electronic networks, so that people will be able to order all kinds of products by tapping out their orders on the computer keyboard.

This arrangement will be a great time saver for busy people, who will be able to pick up their groceries all packaged and ready to be loaded in a car — or have them delivered. If the order can be transmitted easily in codes and charged automatically to the customer's bank, labor costs can be cut drastically.

Additional savings can be realized by computerizing the dispatching of delivery vehicles and routing them efficiently to customers. The end result will likely be that increasing numbers of people will do their shopping electronically.

Teleshopping will make it easier to have goods shipped from warehouses — or even from producers. Fruits and vegetables can be delivered directly to customer's homes rather than having to sit for days or weeks in a store waiting for someone to buy them.

But what about people who want to feel the grapes or thump the honeydew melons? The notion of "feelavision" may strike many people as incredible — about as strange as telephone and television appeared to people in the early 19th century. But advancing technology may soon make it possible. A robot hand, properly designed, could sense the shape and texture of distant fruits and transmit the signals to a human hand on the other side of the world.

"Smellavision" will require the re-creation of scents based on instructions transmitted electronically but already fragrances are being placed on disks which release a scent when scratched by a needle. Duplicating tastes may prove even easier since there are only four basic types of taste receptors (for sweet, sour, salty and bitter); much of the taste of food is really its aroma and texture.

The new technologies will enable more people to work at home. People will communicate rather than commute to their jobs. The home itself will be the principal workplace for many people.

People in many different occupations — commodity traders, architects, stock brokers, lawyers, college professors and many others — will be able to work mainly at home and sally forth only for an occasional appearance in classrooms, courtrooms or other external workplaces.

Of course, many people may find themselves making excuses to take their work outside the home just to have a change in their environment.


PAY
TOLL

Composites

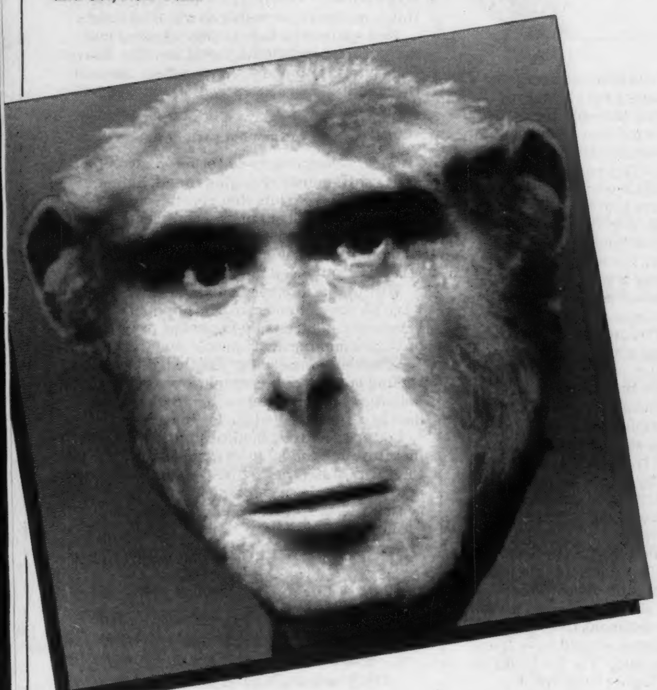
Nancy Burson is not primarily a photographer or even a craftswoman. She is an artist who combines reality with imagination and, with the aid of the computer, transforms it into a creative vision.

In her computer-generated composite portraits, the famous are united in an amalgam of what makes them unique, and concepts become lifelike visions of the future.

Her patented method of synthesizing photographs has made her world famous. Artistically, it challenges fundamental assumptions about the nature of photography. Practically, her computer-enhanced photographs are being used to help parents find their lost children and to allow cosmetic surgery patients to view how their features can be changed.

The book, *Composites, Computer-Generated Portraits*, by Nancy Burson, Richard Carling and David Kramlich, was published in 1986 by Beech Tree Books, William Morrow and Co., New York.

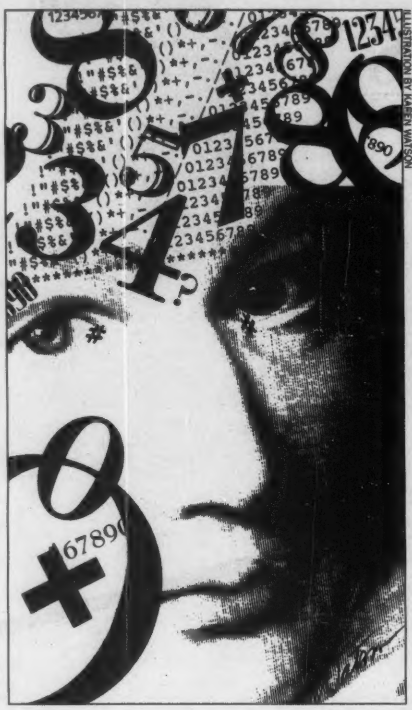

"Cog & Dat"


"Evolution II"


"Mankind"

85.6% and other almost significant numbers

85.6% of us are innumerate, or lacking an understanding of the fundamentals of numbers, and the rest of us don't know what this statistic means



BY DONN PARKER

We are supposed to be an information society, but we are more than that. We have become a number society. Our problems, solutions and issues do not seem valid or significant until they have been expressed in numeric form. This quantified state is facilitated and driven by computers and data communications.

Although we have become a quantified society, we remain innumerate. People are not well adapted to receiving, processing, remembering and outputting numbers.

Numbers should therefore not be forced on the human intellect. Such an imposition will cause a backlash; society will demand a more qualitative, number-free world. A new human right will emerge, existing in parallel with the personal right of privacy. The new right will be that people need quantify and specify information no more than once. Expressed as a principle, it might be that information need be quantified and captured only once.

Consider how many times in our lives we must receive quantified information and then regurgitate it over and over. Examples include addresses, birth dates, Social Security numbers, telephone credit card numbers and banking personal identification numbers. Think of all the addresses and telephone numbers we must remember or write in our little black books.

Having to remember all of this quantified information, enter it on forms or key it one character at a time could be eliminated with the power we are creating with computers and data communications. We can revolutionize our society if we set as a goal achieving and preserving the principle of quantifying no more than once.

Adhering to such a concept could lead to a new qualitative society based on quantitative systems that will process and store information for us and make it available when needed.

I became aware of the gradual emergence of the number society during my 17 years of research and consulting on computer crime and security. I have found that an individual becomes an expert when he can quote numbers; he can establish a fact and settle any argument. It matters little what the number is.

The news media have also gone number crazy. Some journalists don't seem to care what the numbers are as long as they can get someone to quote them. For example, a commonly repeated statistic is that only 1 in 100 computer crimes is discovered. This ridiculous statistic was even the subject of a serious editorial in one of our trade journals.

I am not the only one who has discovered the nature of the number society. Andy Rooney said, "Numbers are the most certain expressions we have. Sports are popular because we are left with two numbers at the end of a game resulting in great satisfaction and finality." He also identified two kinds of workers — those who are judged by numbers, such as salesmen and data entry clerks, and those who are not judged by numbers, such as artists and computer programmers.

Lyndon Johnson said that 4 is the best number. "You must sell in four minutes. Four sentences make a paragraph. Four-letter words are the most important — home, love, food, free and peace, which has five letters but any damn fool knows it should have four." Unfortunately, he also said, "For the first time in history, profits are higher than ever before."

Man has become a measurer. We seem to measure everything, starting from the shepherds of ancient times who counted their sheep by piling stones, one for each, until the present day when Tom Parker became very successful with his new book, *In One Day*. He stated that 17,000 video cassette recorders, 38,000 Ken and Barbie dolls, 82,000 mousetraps, 190,000 watches, 5,000,000 books and 86,000,000 packs of cigarettes are sold each day. The cigarettes leave 85,000 bushels of butts and cause 4,100 heart attacks including 1,500 deaths. In one day, Americans spend $125,000 for Elvis memorabilia, $200,000 for roller skates, $300,000 for clothes and $40,000,000 on prostitutes.

Consider two statements: "85.6% of all businesses that suffered a computer disaster have disappeared within five years." And "93% of all businesses for whatever reason are no longer in business after five years."

The conclusion from these statements is obvious. If a business suffered a computer disaster five or more years ago, it is more likely to be in business today than if it never suffered such a disaster.

The number 85.6 is a particularly good one. Considerable research has led me to believe that 85.6 properly quoted will make an instant expert out of anyone. The number "85" means "most" on a scale of 100; 85 is close to the 80/20 rule. I discovered that 85½ is not a believable number; it sounds like a guess. However, 0.1 away, 0.6, makes this number totally believable and would convince anybody that the person quoting this number must have done some significant research to produce a number like it.

Section 1 of a newspaper on a typical day contained 49 articles. Only one had no numbers in it, and four articles had only one number. The remaining 42 articles were riddled with numbers ranging from 3.38 billion to $3.38. One article pointed out a 0.4% rise in the consumer price index representing a dip in the past 41 months. Who of us reading a newspaper is really interested in whether it was 0.4% or 0.3%, or whether the dip was in the past 40 months or 42 months? The stock market was recently reported as achieving the greatest Dow Jones average fall in history of 86.61 points. Everybody should know that this is not true; the real drop was 85.6 points.

Newspapers include the age of every murderer, rapist and victim. Great benefits derive from quoting numbers, any numbers, because the credibility of a news item is achieved by using a number.

The number society

We are chopping up our otherwise comfortable, continuously changing sound, light and time into discrete bits that give new importance to the word "digitize." Our music is now digitized on compact disks. Soon our voice communications will be digital. Toshiba Ltd. recently announced the first digital television.

Within this number society, however, we have become innumerate. Mathophobia, numberphobia and triskaidekaphobia, or the fear of 13, are making many people social cripples.

Moreover, numerology, like astrology, is becoming popular. For example, numerologists note that every 20 years since 1840, the president in office has died during his term.

Lotteries and commodities futures contracts facilitate our gambling on numbers. In 1985 in New York state, the $41,000,000 in Lotto prizes resulted in a peak sales of 22,000 tickets per minute, despite the odds of one in 6,135,756 of winning.

> *"We have become a worldwide society of numbers. We count and are counted. We measure and are measured. We are identified, codified and described by numbers. Numbers place us in contexts of time, place and circumstance. We can now reduce everything we do to a number language to be acted upon by machines."*

Excerpted from an exhibit at the IBM Gallery of Science and Art

we go crazy with using names made from numbers — 8080 from Intel, 35Z5 for those who remember the old vacuum tube days, the 1103 and 7094 computers, and of course the perennial number 666 as the sign of the devil from Chapter 13 of Revelations in the Bible.

Forty is so significant that Professor Stanley Brandes at the University of California at Berkeley has written an entire book about this one number, *The Number Forty: The Age and the Symbol*. He explains how 40 started as a number representing the end of life and now is the age of the beginning of life, as in Pitkin's *Life Begins at Forty*.

In contrast, a numerate person, besides knowing a little arithmetic and algebra, is one who is not deceived by false statistics. A numerate person can compare large and small numbers with a reasonable degree of logic. He knows the differences between rounding and truncation, significant digits and accuracy and precision of measurements.

He can perform order-of-magnitude arithmetic by adding exponents rather than multiplying large and small numbers. He can estimate logically and knows permutations, combinations and probabilities, including the difference between dependent and independent events.

A numerate person knows a spreadsheet from a bed sheet. He knows the value and unforgiving finality and specificity of numbers. He knows binary from digital from hexadecimal.

Finally, a numerate person knows that computers do not make errors or commit crimes. Computers only manifest the errors or imprudent or risky decisions that are made by people.

An innumerate society

Darrell Huff published his famous book, *How to Lie with Statistics*, in 1954. From that book and other sources, I have identified 11 basic methods of deception using statistics, including built-in sample biases, abuse of samples, false actuarial application, or data on individuals applying to groups and the use of arithmetic, geometric, median, modal and harmonic averages (if one of these doesn't prove the point, another can be used). Other methods of deception include ignorance of regression toward the mean, the use of favorite statistics, such as the Dow Jones Industrial Average, the semi-attached value, post-hoc fallacy and the shifting base.

Graphs are valuable for representing numbers because they exploit human information processing capabilities. A picture is worth a thousand numbers, and each individual color added to a graph increases its validity by an order of magnitude. Many concerned people are battling today about how to honestly represent numbers in graphs and there seems to be little agreement.

Edward Tufte, a professor of political science and statistics at Yale University, is intent on eliminating chart junk. Nigel Holmes, a graphic artist at *Time* magazine, states that some distortion in graphs is acceptable to emphasize a particular characteristic of a set of numbers.

I have identified 14 methods of deception using graphics, including baseline truncation by chopping off the bottoms of charts, changing baselines, distorting scales, tilting graphs to make curves rise more rapidly, surface distortion, unequal time periods, omission of data, bar graph truncation, cartooning of graphs, perspective distortion, dimension distortion and double ordinants.

Not only can we lie with graphics, but we can do it with increasing productivity as our computer graphics capabilities grow.

The primary industry in the U.S. today is probably the manufacturing of numbers. The office is the factory, and the computer is its primary mechanism. Entire office buildings have now become giant, multicomputer centers. Number workers are increasing at the rate of one million per year and represent 85.6% of the work force. The actual number is 75%, but who would believe it?

Yet the office remains the last stronghold of inefficiency in the business world because the keyboard is unfit for human use. We need convenient, low-cost and effortless entry, processing, storage and conversion of numbers. This need requires the demise of the keyboard as we know it today.

A qualitative society

The more we become a society driven by numbers and know more quantitatively about our activities and behavior, the higher our quality of life should become — as long as we can rely on machines and data communications to do our number work. The new society will also increase our quality of living by reducing the redundancy of human quantitative activity and by eliminating innumeracy.

Examples that move us closer to the numerate society include analog, qualitative input and output such as by voice; automatic payroll deposit; direct wholesaler, retailer and consumer order entry; automatic account balancing and creditor payments; automatic income tax calculation, management and payment; biometric signatures eliminating the need for user identifications and secret passwords; automatic hotel registration; and car rental and navigation on roads and streets. These applications represent a movement toward one quantification at the source.

A strong inhibiting factor in this movement toward a qualitative society arose with the threat of the national data base concept where, in order to free us from having to

know quantitative information, a data base about us must be formed. Many people resist this concept because of privacy and intrusion considerations; yet by default, we are rapidly moving toward an international, universal decentralized data base system.

More and more computers are being connected through data communications made possible with satellites and fiber optics. Eventually, all our computers will form one giant network.

Americans also resist the Social Security number as a universal identifier. Legislative controls slowed the movement toward universal identifiers, but with the increasing power of computers, we no longer need an explicit universal identifier. We will become known by combining bits of unique information about each of us.

The universal data base is thus unalterably on its way. It will be transparent to most humans. Input of quantified information will occur at the source of that information. Output of quantified information will occur at the many locations of its use. Keyboards for entry of individual characters will be eliminated.

Concern about the universal, decentralized data base system is valid. It could pose a massive threat to people through violation of personal privacy and inappropriate intrusions into business, government and other institutions. Major advances must be made in information security, control and integrity.

We require the freedom from loss associated with our quantified information caused by modification, contamination, destruction, denial of use, loss of control, unauthorized use, disclosure, misrepresentation, misappropriation, misplacement and trespass.

We will require more from everything digital, including processing, communications, storage and, above all, assurance of security, control and integrity. We will need more data stored in our computer systems controlling and directing appropriate access to information than the volume of the operational information itself. This will be feasible as the cost of computing and communications drops rapidly.

We can improve the quality of life through advances in computer and communications technology as long as we can eliminate innumeracy through education as well as preserve privacy, integrity and security through an appropriate emphasis on the self-interest of our government, businesses, citizens and institutions and appropriate legislation where self-interest fails.

Our goal is to achieve the right of quantification no more than once.

Parker is a senior management systems consultant at SRI International, Inc. in Menlo Park, Calif., where he researches and consults on information and computer crime and security. This article is based on his forthcoming book, The Numbering of America, *to be published in 1987.*

HANDS-ON

Uncovering politicians' hidden personalities

Politicians are masters of disguise, often hiding their real natures behind rhetoric and stock imagery. But a professor of speech communication at the University of Texas in Austin has figured out a way to lift a corner of the political mask by using a computer to analyze clues to personality that can be found in word usage.

Rod Hart, who teaches courses in political communication and theories of persuasion, created a Cobol program, Diction, that incorporates about 30 dictionaries and subdictionaries. Using roughly 3,000 search words, Diction analyzed the linguistic attributes of eight U.S. presidents, from Harry Truman to Ronald Reagan.

This project, which Hart began when he was teaching at Purdue University and carried with him to the University of Texas in 1979, produced a book in 1984 titled *Verbal Style and the Presidency*, published by Academic Press of New York.

The thesis of Hart's work is that while individuals can control the ideas and images that their messages convey, they cannot continuously edit themselves in selecting words. This being the case, he says, analysis of language can provide glimpses of the real people behind the public figures.

Hart established four major categories of language style as the basis for comparisons: realism, certainty, optimism and activity. Feeding passages from speeches of the various presidents into the computer, he had his program search for matches between words used and words stored in dictionaries and subdictionaries.

When sorting for realism, Hart's program would look for indicators such as concrete nouns like "airplane" or "armies." "Realism," he says, "means dealing with objects in the real world, rather than abstract concepts like 'faith' or 'patriotism.' "

Among the key words signaling certainty are terms like "everyone" or "always" or any form of the verb to be, which Hart says is "the strongest verb construction in the English language." Optimism, not surprisingly, was linked to terms like "splendid," "successful," "exciting" and "hopeful."

Among Hart's discoveries was one largely unobserved characteristic of Ronald Reagan's speaking style that may, in fact, significantly bear on his reputation as a great communicator. Of all the presidents studied, Hart says, Reagan ranked lowest on use of embellishments; almost all of his language is composed of nouns and verbs. That trait comes across as active and dynamic, Hart explains, and, since it also happens to match the style of contemporary journalism, "tends to make him a very quotable guy."

Jimmy Carter, on the other hand, may have been tripped up by his own intellect, according to Hart's analysis. "I was particularly curious about what it was, exactly, that made his speaking style so sonorous," he says, "and what I found was that he had an extraordinarily rich and extended vocabulary and tended to use large words. On average, his words were seven characters long, which contrasts with a 4½-character average for the other seven presidents."

In his quest to understand the men who reach the Oval Office, Hart used his program not only to scrutinize their words but also to compare their language patterns against those of religious figures, business leaders and social activists. What he found through this comparison, he says, was that the role of president seems to demand a mode of expression that combines "the optimism of a preacher with the concreteness of a corporate executive presenting an annual report and the energy of a social activist."

Hart is now reformulating Diction, which has been running on a Control Data Corp. CDC 6300 mainframe, for use on a microcomputer, probably an IBM Personal Computer AT.

COMMENT

As society changes, computers should enable people to cope with the increasing complexity and requirements of the information age.

For example, in all likelihood, people graduating from school today will work at four or five different careers during their lifetime. Computers should be the repositories of information so that these people can spend their education developing their critical analysis and conceptual skills rather than just learning facts.

With the amount of information doubling at a rate of approximately every two to three years, people in businesses have two choices — to be overwhelmed with information and unable to cope or to learn to transform massive amounts of information into usable knowledge.

As computers become easier to use, applications such as data bases will give people the tools that help them organize and select information and, hence, better perform their jobs.

We see the computer as this wonderful machine that can expand the intellectual capacity of a person. It can make it possible for people to communicate better, to learn better, to work better and to do things that were not possible before the computer was available.

JOHN SCULLEY
President, Apple Computer, Inc.

Making music with help from a PC

BY PETER NERO

My Tandy Corp. TRS-80 Model I, which is now packed and saved for posterity, bears serial number 26. That fact should convey the speed at which I reacted when the dream of a personal computer became a reality. The era in which I grew up was rife with predictions of a Buck Rogers future, and the realization that the future would happen in my lifetime was too good to be true.

The year 1977 marked the 43rd of my life and 36 years of working toward perfection as a musician. While it had become apparent that perfection would only be a goal and not a reality, I had achieved a good deal of success within the profession and a commensurate amount of skill. While we, as artists, always hope to continue to grow, the quantum leaps take place at an earlier age and subsequent growth seems to level off at a comfortable, though lesser, pace.

Therefore, imagine the challenge of sitting in front of a keyboard with its powerful potential and feeling like a complete idiot. This was one keyboard that now had a true novice for a "player."

Since hardware always seems to be available before software and I was in no mood to wait, I decided to write my own programs. After countless hours of study, experimentation and private tutoring, I was still a novice but had completed my first program. That was a quantum leap. I was extremely proud that it was accepted for publication in a computer magazine, and when it appeared in print several months later, I was already embarrassed — a good sign that progress was rapid.

Though professional programs are available for countless applications, I still prefer to write my own, custom-made for the demands of my specific business. Since I am on tour for a total of six months each year, I rely heavily on laptops. This takes extra care in memory conservation and is a good exercise in improving one's skills.

Like most others in my field, I have a personal manager, agent, business manager, public relations person and so on. Yet, as others in my profession have learned, the performer must be aware and in control of all aspects of the business. The romantic notion that the artist is some ethereal being who does nothing but practice his art is long gone. Our profession has become big business and, like other big businesses, needs a chief executive officer.

Since about 90% of my time is consumed by the foregoing, little time is left for musical creativity. The use of a computer is now making it possible to watch the store more effectively while freeing time for more important matters.

In a typical year, I perform about 50 different concert programs as guest conductor/pianist with symphony orchestras. I plan these programs using the following criteria: the skill of the players, amount of rehearsal time available, repertoire performed by me in recent appearances with them, sophistication or lack of same of that audience and other repertoire recently performed or to be performed by other artists.

Combine these criteria with the fact that I have some 500 selections that I am prepared to play and/or conduct, and you have a time-consuming and arduous task.

Before I completed my program, written in Basic, to handle this chore, I would have to go to the file cabinet to locate programs from previous appearances. I would then, from a master repertoire list, delete those selections recently performed. Next, I would begin to scan the list to choose selections that would fit the other criteria. This process took many, many scannings — writing down all the possibilities, reducing that number to about 200, paring down subsequent lists and so on.

What used to take hours now takes minutes. The Basic program I wrote contains a data base of my repertoire as well as a record of all previous concerts played. It compares the two and deletes from the data base all selections previously played. From the remainder I can ask for an opener of, say, between three and five minutes' duration, fast tempo, not too difficult and appropriate for the occasion.

In a few seconds, I get my choices printed and take my pick. This process is repeated for the rest of the program selections, using the variety of criteria I have made available, and in about 15 minutes, the once-arduous task is completed.

Now I can go back to practicing my craft, which, until recently, took a back seat to paperwork. Happy birthday, Eniac!

Nero, a pianist, arranger and conductor, is currently the music director and conductor of the Philadelphia Pops Orchestra.

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> *Computer: One who computes; a calculator, reckoner; specifically a person employed to make calculations in an observatory, in surveying, etc.*

OXFORD ENGLISH DICTIONARY

COMMENT

Penetrating the mysteries of the physical world has been the great frontier of the last century. Advances have been astounding in understanding physical science and its applications. But there has been no comparable advance in understanding our social systems. Why not?

Social systems are far more complex than technological systems. Only in the last two decades have means become available for understanding social systems to the degree that we take for granted with physical systems.

Mathematically speaking, social systems belong to that class known as high-order, nonlinear, differential equations. Biological evolution has not required that the human mind develop in a way that can deal with such systems. As a result, wars, economic depressions, unemployment, repressive governments, hunger and rising pollution testify to the fact that we do not manage social systems for the long-term good of the world.

But now, computers are opening the door to an understanding of social systems. The great frontier of the next 100 years will be learning how to manage social systems, just as the frontier of the last century was learning how to harness technology.

Computers can now handle the complexity inherent in social and economic systems. In doing so, they draw together the understanding of feedback dynamics that evolved in technology during the last 50 years and the vast store of knowledge about the structure and the governing policies that resides in people's heads.

The mental data base is rich in the information necessary for understanding human systems. However, until feedback concepts and computers became available to organize that knowledge, little can be done to relate organizational policies to the resulting behavior.

Now there is beginning to be effective computer simulation modeling of economic systems, urban growth and decay, dynamic processes of internal medicine and corporate growth and instability.

The next great frontier will be understanding ourselves and our institutions. The next century should see the same rapid progress in social systems that the last century has demonstrated in physical systems.

JAY FORRESTER
Professor of management at MIT's Sloan School

Change, growth & trauma

BY GENE AMDAHL
Chairman, Trilogy Systems

After accepting the invitation to write about the role computers should play in society, I discovered that this topic was far more treacherous than a first impression would suggest.

We are not only a highly diverse society, but in the case of computers, we are presented with the first reasonable promise of an opportunity for mankind to create an entity in its own image.

It may seem inane to some that one should be concerned with the potential for a god-like misuse of technology, but all of history suggests that the prime exploitation will occur in applications involving a struggle for power — both economic and political.

In spite of this concern, I believe that an enormous benefit to mankind is possible. Almost none of this benefit will be trauma-free, however, for the benefits will principally derive from the restructuring of social productivity.

Trauma of change

Change always involves uncertainty and displacement, which consequently produces trauma. But change is also an essential component of growth, so it must not be discouraged.

Perhaps the least socially traumatic uses will occur in areas like prostheses for physical handicaps. Trauma will increase, however, as the prosthetic applications move into intelligence enhancement areas, although the social benefits may be both larger and more general.

Expert systems clearly provide greater availability of top caliber expertise while simultaneously providing for potential elimination of the lesser ranks of experts.

Monitoring and control systems would seem relatively trauma-free, for one first visualizes such things as life-support systems in hospitals or perhaps earthquake or hurricane warning systems. We then may include warning systems for military strikes and find that these systems imply a counter system and a strike force escalation.

A monitoring example with traumatic overtones is in place today observing trading prices on three independent exchanges. Whenever price divergences exceed a threshold, trades are executed to capitalize upon the discrepancy. This capability makes the market much more volatile.

Improved and more available supercomputers provide means for performing physics, chemistry and engineering in the computer center rather than the laboratory. The costs and risks can be reduced by some experiments permitted that otherwise could not be performed.

These should provide enormous social benefits in many areas. However, they are currently the weapons in a global struggle among industrialized countries to retain or attain first-tier positions in world trade.

Data bases have already shown both the beneficial and traumatic sides, and some legal steps have been taken throughout many parts

In the case of computers, we are presented with the promise of an opportunity for mankind to create an entity in its own image.

of the world to control misuse of the data.

Automation also has already caused social displacement, beginning with clerical automation. The current automation of manufacturing tasks clearly has the same effect. But the economic necessity is indisputable.

Entertainment and education may well be the areas in which the benefits will occur with moderate trauma. This will be the case as long as the contributions are largely additive rather than substitutive.

A most certain characteristic of the future roles for computers is that they will be controversial. This characteristic will probably receive far more public attention than will the beneficial results.

"Computing machines perhaps can do the work of a dozen ordinary men, but there is no machine that can do the work of one extraordinary man."

E. B. WHITE

From automated to cybernetic social systems

BY CARL HAMMER

Scientists the world over are facing an awesome responsibility as their work brings them ever closer to the point where drastic and possibly irreversible alterations in our earthly environment are taking effect.

Some of these changes, such as in the temperature of our atmosphere or of the oceans, results from the increasing pollution that our engineering technology produces. Others could develop from planned experiments of a global nature, such as redistribution of the water on the surface of the earth or an attempt to control weather and climate over cities and even continents.

The solution of these complex ecological problems will require the application of electronic computer systems to a degree that by far exceeds their seemingly miraculous powers of today. When the German-Swiss mathematician Leonhard Euler completed his calculation of pi to 600 decimals about 200 years ago, he concluded this Herculean effort with the laconic remark that "it would be impossible" to extend this computation further because of the excessive amount of manpower needed.

Yet, in the past 25 years we have computed pi first to 2,000, then to 10,000 and finally to 100,000 decimals. Therefore, let us beware of attaching the label of impossibility to achievements whose implementation we cannot readily foresee. After all, space travel, atomic energy, color television and global communications, to mention just a few, were unheard of only 50 years ago, but they are now an integral part of our everyday life.

The role that electronic systems have played in making these accomplishments come true is basic to our understanding of the future. Man's early engineering activities were predominantly concerned with making tools to augment his muscle. Developments in that area are still continuing with the design of larger engines, machines and devices to provide us with a mechanical advantage over nature — or ourselves.

With the invention of the automobile, for example, man increased his mobility by a factor of at least 100; the airplane bought him another order of magnitude. In fact, his innate desire to conquer and control his environment has given man a leverage of about three orders of magnitude in every area to which he applied his inventive genius. However, the laws of physics and mechanics will prevail, and even the fantastic astronautical velocities do not exceed those of walking man by more than six orders of magnitude.

During the late 1930s, man's voracious appetite for computing power became apparent. We developed machines that could store their own programs, or computing recipes, in order to achieve greater speeds than interaction of human operators and electromechanical calculators had furnished in the past.

These machines, designed to augment man's mind, gave him almost at once a leverage factor of 10,000 (with the invention of the Eniac), and today's supercomputers provide us with an advantage of one billion to one. But we note that even these seemingly miraculous accomplishments will soon be dwarfed by new designs already on the drawing board.

The introduction of electronic systems into our society has already caused profound changes in its structure and organization. Large-scale business data processing without the aid of these machines has become unthinkable. Real-time systems and time sharing make the power of the computer available to untold thousands at their desks and even in their homes. Global networks provide electronic message and circuit switching services to an exponentially expanding circle of users. And yet, this is only the beginning; the real impact of electronic systems upon human society and the way it is structured will be felt for decades.

It is this power of which we, as responsible managers, are custodians. We must learn to understand the challenging problems that it poses toward achieving a balance between hardware, software and brainware. J. J. Servan-Schreiber has given eloquent testimony to the accomplishments of American management.

However, we should add an important statistic to the wealth already supplied in his *American Challenge*. In terms of equivalent human data processing capabilities, the power available from our 60 million electronic computer systems augments the brainpower of this nation of 240 million people to an equivalance level of 400 billion people. The spread of the technology gap between this country and the rest of the world is thus readily understood by observing that the U.S. is already a mind-amplifier system with a built-in amplification factor of 2000:1. If it were not for the silent (and patient) majority of these fictitious 400 billion electronic workers, the technology and affluence gap noted by Servan-Schreiber would not have developed. Nor would we present a real threat to the technology balance of the other national systems of our global population.

Thus we must understand that we are in the midst of a transition from an automated to a cybernetic society. By the end of the century, electronic systems will affect and even control practically every aspect of human endeavor. Every person will have then at his or her disposal a vast complex of computer services. Information utilities and data banks, for example, will make computer power available to the public in the same way that electric or other utilities today service our homes and offices. High-speed communications systems, on a global basis, will transmit data and messages almost instantaneously between any two points on earth or colonized space. Government officials, businessmen, scientists, students, even housewives and children will communicate with computers as readily as they now talk by telephone.

The outlook is very bright indeed if we just learn how to make intelligent use of our not-always-so-intelligent and often maligned machines.

Man is still very reluctant to entrust his fate to a machine. But as we perfect the decision making models, more of the real-time processes in our society will be turned over to the machine for monitoring, reporting and control. In most instances, these models — especially in the field of economics, planning and scheduling — are still rudimentary.

But there can be no doubt that we will improve them to a point where their power or artificial intelligence will at least equal that of their human masters. The speed with which the machine can react already exceeds by far man's own response time. Soon we will begin to experiment with

....

"*Your home, and indeed some Cadillacs, have more computing power than many third-world nations.*"

DANIEL SIEWIOREK
Professor, Carnegie-Mellon University

HANDS-ON

Ann Landers as cultural map

Ann Landers may have all the answers, but it took a literature professor with a computer to organize the 35,000 letters she has received during the past 30 years into a composite picture of a changing society.

David Grossvogel, professor of comparative literature at Cornell University in Ithaca, N.Y., first got the idea of using the advice columnist as the basis for a study of how our language and mores have evolved when he began to notice just how frequently Landers' name seemed to come up in faculty club discussions. "It occurred to me that she was a frequent source of conversation," he says. "And what surprised me even more was that my colleagues were taking her column very seriously and building arguments around points she had made."

Grossvogel had undertaken research on popular culture in the past. One of his projects was a book on images of the detective in modern literature. He quickly realized that the conventional tools of liberal arts research — file cards and a good memory — would not be adequate to support the kind of study he now had in mind. Luckily for Grossvogel, his need coincided with interest from IBM in encouraging the use of computers for academic research and the development of innovative instructional tools.

Grossvogel became one of the first beneficiaries of Project Ezra, a three-year, $8 million IBM grant program that began in July 1984 and was named after Cornell's founder. Given his choice of IBM equipment to work with, Grossvogel chose a Personal Computer XT with a hard disk. Then, after customizing Datafax commercial file management software from Link Systems in Santa Monica, Calif., he set out to do what he says few humanists had ever done before — use a computer as a systematic tool for linguistic and sociological research.

The result is a book manuscript, completed last May, which Grossvogel has tentatively titled *Perplexed in South Dakota: Ann Landers and the Changing Image of America*.

The research didn't produce any major surprises, according to Grossvogel. "With something like this," he says, "you really only wind up confirming things that you had previously suspected — like the fact that family relationships became strained in the '60s and snapped in the '70s."

As a linguistic observer, he says one of the most interesting aspects of investigation was tracing the speed with which family newspapers threw off their language restraints after Landers first printed the word "sex" in her column in 1960. It was also intriguing, he adds, to follow the evolution of the column's demographics over the years. What started out mainly as a newspaper feature appealing to teenagers in need of advice in 1955 is now a primarily adult-oriented column.

As his observations at the faculty club first suggested, Grossvogel found that Landers' readership has undergone a distinct gentrification in recent years.

He finds some irony in the fact that the woman whose correspondence he has cataloged and analyzed with the aid of the computer is, herself, fiercely computerphobic.

"Ann Landers hates computers," he says. "Since 1970, which is when the word first occurred, almost every mention of computers in her column has involved suggestions from readers that she try the technology. Sometimes people even bring it up as part of a larger argument about her need to modernize her viewpoint."

Landers may change her mind about some things, but computers are one issue on which she has never given any ground, according to Grossvogel. "She keeps swearing she'll never give up her old typewriter. I guess it is an emblem of her basically conservative nature."

more sophisticated models, and their ultimate adoption even in economic process control by the turn of the century seems certain.

The very structure of our society will thus change under the impact of these developments. The introduction of a universal personal identification code may soon eliminate largely the need for physical money and usher in the much-publicized cashless and checkless society.

Elaborate and universal display apparatus located in our homes will permit an untold number to be on the job without having to commute to offices and other places of business, thereby making travel either a matter of pleasure or of dire emergency. The very same devices will be used to display newspapers, books or learning materials, and they may well put the stamp of obsolescence on all printed matter.

Computer-aided training, instruction and education will become commonplace where it is the exception now, affording everyone the advantages of higher learning.

Mind-amplifying power

In fact, the mind-amplifiying power of electronic systems will be brought to bear upon all those activities that now suffer from excessive and repetitive rote detail that can — and should — be done by a machine, not man.

The compilation of national or international legal thesauri will enable lawyers to spend more of their valuable time in making decisions, not legal searches. Development of large data bases in medicine will greatly improve the ability of diagnosticians and hospitals to provide better medical care for all people at a lower cost.

The most mundane as well as the most sophisticated operations within our complex system will come under scrutiny everywhere; as cost-performance ratios improve, management will insert machines into the system in ever increasing numbers.

Soon to take over

Some day soon, electronic systems are certain to take over practically all the tasks of rote and drudgery that nature and society now impose upon us. Therefore, man must set higher goals for himself technically, politically and psychologically or run the risk of economic and technological enslavement.

It will take all of our ability, energy and resolve to make certain that we remain masters of our own fate in the coming of this cybernetic culture.

The outlook is indeed very bright if we just learn how to make intelligent use of our not-always-so-intelligent and often maligned machines.

Norbert Wiener once said, "It is a degradation to a human being to chain him to an oar and use him as a source of power: but it is an equal degradation to assign him a purely repetitive task which demands less than a millionth of his brain capacity."

As we advance with the development of a mind-amplifying societal system, we must also learn to harness its enormous power and manage it for the benefit of all mankind.

....

" *The basic set of abilities that we call 'thinking' is something humans share a little bit with their cats and dogs and a lot more with their computers. When appropriately programmed computers solve a problem, they make the same kind of highly selective search among possibilities and the same kind of inferences I see my friends making. Computers have the capacity to build up a very large assembly of recognized patterns, and the information associated with them, in the same selective way that humans do. So I see no reason to use the word 'thinking' in the case of humans unless I'm also willing to apply it to computers. Viewing computers in this light can be fairly upsetting if your life is made worthwhile by the thought that humans are different. But maybe uniqueness is a poor way to look for one's values in life. Maybe we ought to look at the world in terms of what we share with the rest of nature rather than looking for that uniqueness.* "

HERBERT A. SIMON
Professor of computer science and psychology, Carnegie-Mellon University

Technology is straining economic and legal systems

SAM NUNN
U.S. Senator, Georgia

Information systems of all kinds are playing an increasingly important and controlling role in American society. Sophisticated computer technology is being used routinely in business, education, government and the military. It is being used for information storage, processing, management and decision making. Most of this technology was not even in the conceptual phase several years ago.

The introduction of additional information technology is driving social and economic changes. Most of these changes are benefiting our society and generally improving the quality of our lives. In the next few years, information technologies will continue to undergo rapid development and will be applied to a growing number of activities. However, these changes appear to be rapidly outpacing the capacity of our economic and legal systems.

To date, policy development regarding the information age has been a piecemeal effort and generally reactive to situations on an ad hoc basis. We cannot continue to deal with critical national issues in such a fashion. I believe it is worth the time and effort to take a step beyond our current reactive efforts and attempt to identify general focal points for resolving these issues at the national level.

With this in mind, Sen. Frank Lautenberg (D-N.J.) and I joined together last year to introduce the Information Age Commission Act. This legislation would create a forum for discussions of the present and future impact of computer and communications systems on our nation and its citizens. It would attempt to present critical choices to the president, Congress and the public that will maximize the benefits of the information age to our society.

The commission, which would be funded from private industry sources, would be composed of 23 members drawn from government at all levels, industry, labor, education and academia. This mix will enable the commission to work with a diverse perspective that can only strengthen the product of its labors.

The studies conducted by the commission will include the efforts and resources needed to do the following:

- Maximize the benefits to society of computer and communications systems.
- Maintain the lead of the U.S. in the world information marketplace.
- Educate and re-educate our people.
- Assess the impact of computers and communications systems on our national security, labor and employment.
- Encourage technological innovations.

The Information Age Commission legislation was approved by the Senate Governmental Affairs Committee on Aug. 12. I am optimistic that the full Senate will adopt this important measure soon. We hope that the House of Representatives will see fit to approve a similar bill so that the commission's important work can begin.

A bill to establish an Information Age Commission

Following are excerpts of Senate bill S. 786, introduced by Sen. Sam Nunn (D-Ga.) and Sen. Frank R. Lautenberg (D-N.J.) in March 1985. The bill was considered favorably by the Senate this fall, but it is not expected to receive final approval from Congress and the president until early next year.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that this act may be cited as the "Information Age Commission Act of 1985."

Section 2. The Congress finds and declares that:

1. The introduction and use of computer and communications systems have brought our nation and the world into the information age;
2. Computer and communications systems are affecting the manner in which business, education and government operate and the manner in which our nation's security and involvement in world trade are carried out;
3. The rapid pace of technological change and the complexity of the issues involved with respect to computers and communications systems have combined to diminish public awareness and understanding of their impact on society;
4. The impact of computer and communications systems on society has not been completely analyzed; and
5. While Congress has begun to address issues relating to the information age, such as intellectual property rights, computer education, computer crime and privacy, there remains a need for a comprehensive and systematic study of the information age.

Section 3. The purposes of this Act are to:

1. Create a forum for discussions and targeted research on the present and future impact of computer and communications systems on our nation and its citizens; and
2. Present critical alternative views and choices to the president, Congress and the public generally, so that such views and choices may serve as a catalyst for change, if necessary, and maximize the benefits of the information age to our society.

Section 4. There is established a commission to be known as the Information Age Commission.

Section 5. The commission shall conduct or have conducted, through subcommittees or study groups, such research and studies as it determines necessary to develop a responsible understanding of the information age, including, but not limited to —

1. The efforts and resources needed to maximize the benefit to society of computer and communications systems;
2. The effort and resources needed to maintain the lead of the United States in the world information marketplace;
3. The education and re-education required to equip the people of the United States for the information age;
4. The use and impact of computer and communications systems on the national defense of the United States;
5. The effort and resources needed to encourage new technological innovations; and
6. The impact of computer and communications systems on labor and employment.

HANDS-ON

Building a population model

Steven Caldwell has a lot of questions about the distribution of income and wealth in the United States. "I want to be able to look at the impact of all kinds of factors," he says, "from tax policy to racial discrimination and childbearing."

What Caldwell is talking about will require building a model of the population, consisting of detailed profiles of 100,000 or so individuals for what in research parlance is called a "microanalytic simulation." The term micro in this context has nothing to do with microcomputers.

Since mainframes are expensive and access for professors tends to be limited, microanalytic simulation "won't really be a tool for academics until it can be run on a personal computer," Caldwell maintains.

Such an application is Caldwell's goal under the IBM-funded Project Ezra grant program at Cornell University in Ithaca, N.Y. He is developing models on a variety of minis and even a supercomputer, writing in the C language, with the intent of porting them over for research with smaller samples on a memory-enhanced IBM Personal Computer AT. "It's not a useful research tool yet," Caldwell notes, "but we've gone far enough to know that it is absolutely feasible."

In the meantime, Caldwell's students are benefiting from a number of small models he has created to run on classroom-dedicated IBM Personal Computer XTs.

The instructional programs are all menu-driven and equipped with graphics, so that students can see their findings in the form of bar graphs or histograms.

No one is going to come up with any startling new information using these programs, Caldwell says. But process, not product, is the point here.

"The big gain from using the computer and computer models as part of instruction is that it makes the students into active participants," he says. "They say they enjoy the class more. But what's even more important, they say that things fall into place for them when they can see for themselves how different factors can influence outcome."

COMMENT

The computer is with us. There is no choice other than to exploit its potential.

I have been involved with computer painting, which is still in its infancy, so there is no forecasting to what extent it will change creators and viewers, but it will make itself felt.

Painting is a physical process which includes hard work, toxic fumes, stains and a good deal of studio space.

Painting with the computer requires less space, is sanitary and liberates the artist to make and alter his images more quickly.

In 1978 I was involved with CBS as a computer artist at the Superbowl in New Orleans.

As I picked up the action on the field, images passed through my hands into the computer and onto my monitor. I related these images to the live action, and they were at the same moment witnessed by home viewers.

This experience was very meaningful for me; time will bear out its significance upon further development of this form.

LEROY NEIMAN
Artist

HANDS-ON

Cleveland writes a prescription for its electronic city

It started with a small electronic bulletin board designed to handle internal communication for the Department of Family Medicine at Case Western Reserve University's School of Medicine, which operated five clinical units at hospitals located in and around Cleveland.

The department connected a cast-off Apple Computer, Inc. Apple II+ microcomputer to a phone line with a 300 bit/sec. Hayes Microcomputer Products, Inc. Micromodem II and set up the bulletin board so that faculty and staff located in the various clinics could communicate with each other. Somehow, though, the number got out and people from outside the university started leaving messages.

In and of itself, that would not have been surprising, says Thomas Grundner, assistant professor in the School of Medicine and creator of the bulletin board, since access numbers frequently find their way into the hands of outsiders. What did surprise and interest Grundner as a medical educator, however, were the kinds of messages he was finding. They were serious medically related questions that people had obviously left in hope of receiving an answer. "When I saw that," he says, "I thought, 'Wait a minute, there's something interesting going on here. People are using this bulletin board to reach out for information and assistance.' "

Impressed by the significance of the phenomenon, Grundner sat down and wrote a program to accommodate these outside users, complete with menus and Help screens. This new system, called "St. Silicon's Hospital and Information Dispensary," was opened to both the public and other medical professionals in the Cleveland area in February 1985.

A medical clinic, or "doc-in-the-box" feature, formalized the spontaneous question-and-answer process. Faculty members who were certified family practitioners were deputized to monitor and respond to inquiries with general information. They were specifically instructed not to attempt to diagnose or treat.

Response to the system was rapid and enthusiastic. The St. Silicon's Hospital line logged more than 100 calls in its second week and eventually reached an average of 300 per week. According to Grundner, the questions asked fell into three general categories: ones that should have been posed in a doctor's office or that had been asked and inadequately answered, ones that callers hesitated to ask their own doctors because they seemed too trivial and ones that callers would have had difficulty asking face to face.

Just as St. Silicon's was beginning to stretch the limit of its facilities, AT&T Information Systems heard about the project and offered $50,000 worth of computer equipment and software.

The facility was equipped with an AT&T 3B2/400 computer with 4M bytes of random-access memory and 144M bytes of hard disk storage as well as 15 1,200/300 bit/sec. modems and custom-written Unix software. With these resources, Grundner decided he had the makings for not just an expanded electronic medical facility, but eventually an entire electronic city.

That city is now a reality called the Cleveland Free-Net. Opened officially July 16, the Free-Net is a free and open-access community computer system supported not just by the initial AT&T donation but also by contributions from Case Western Reserve's School of Medicine and university hospitals as well as a host of other organizations and individuals throughout the greater Cleveland area.

Although building continues, the Cleveland Free-Net already possesses much of what one would expect of a brick-and-mortar town. "Every city has a post office, and so do we," Grundner says. "We provide free electronic mail service to anyone in northeast Ohio who wants to register on the system."

There's also a courthouse, where volunteer lawyers answer users' questions about the law; a government house, which is an electronic connection to elected local, state and national officials; and a schoolhouse, which is an electronic communications system allowing both information exchange among Cleveland-area schools and the creation of common data bases that can be accessed by teachers, administrators, students and parents.

"When you start thinking about something like this in terms of the metaphor of a city, you realize that the possibilities are practically endless," Grundner says.

Grundner envisions similar free community computer systems spreading across the country. The Cleveland Free-Net is ready to do its part to help. Qualified groups from any other city are invited to lease the software on which the Free-Net is built for $1 a year.

> *"The computer is the brain outside the brain. With it, we extend our minds in a way that will make a better world for everyone. The pessimists are wrong! More people can live better than ever if we just apply the human mind for good and not for greed or war. Our only limitation now is fear and ignorance."*
>
> **EDMUND G. BROWN JR.**
> **Ex-governor, California**

When logical computers meet people's emotions

DR. JOYCE BROTHERS

We're in a new computer age. Dad works with a computer at work. Mom has one at home to help with budgeting and marketing. The kids work on computers at school and play games on the computer when they get home. It's a whole new happy world.

Then why is everybody so tense? Why does Dad retire to his study at the end of the day and not talk to anybody? Why did Johnny throw his chair through his computer screen when it rejected his commands?

San Diego psychologist Thomas McDonald has been getting more and more computer-frustrated people in his office recently. They come in, at first, because they're anxious or their marriages are failing, but when he probes he finds that the computer is at the root of the problem. "We've plopped down a highly technological thing in the lives of people who are unprepared for it," he explains.

McDonald saw so many of these clients that he met with the San Diego Data Processing Association and asked them about the stress that computers have brought into their lives. "It was like turning on a spigot," he says. "Nobody had ever asked them about stress before." They all knew the stress of working with computers.

Computers are logic only, McDonald explains. People are emotional and spiritual, too. When they work with computers, they have to discard these aspects of themselves, and when they do it for eight hours a day, day after day, they may forget how to be emotional and spiritual. They may find it too difficult to relate to spouse and children when they get home, so they retire into the study with computer games.

Life with a computer in the office isn't easy either. Not everybody has a computer, and those who don't rarely understand them. They think you have a magic machine and should be able to perform miracles on it. When you can't, you get frustrated.

McDonald finds that bosses and businesses tolerate a great deal more problems among people who work with computers than they would tolerate among other employees.

People who work with computers have to learn how to relax, McDonald says. He suggests programming the computer to announce at intervals: "We've had enough now."

Learn to accept mistakes, he says. You're human. You're fallible. You aren't a computer. Tell your boss and co-workers to expect mistakes, too. Computers are with us to stay, McDonald says. So we must learn to live with them without destroying ourselves.

What's bad, McDonald says, is when businesses and the people who work with computers forget that people are more important than machines. Always.

Boys, girls and computers

Rarely do you see girls or women in a pool hall. That's a male domain. So, it turns out, are video arcades, where many boys get their first experience with computers. This observation comes from researchers Sara Kiesler and Lee Sproull, of Carnegie-Mellon University, and Jacquelynne Eccles of the University of Michigan.

They observed players in video arcades in Pittsburgh, San Diego, Atlanta and Tel Aviv and found anywhere from twice as many males as females to eight times as many males.

"Video arcades are places where adolescent males hang out," the researchers conclude. "Occasionally they bring their girlfriends, but the girls watch while the boys play."

Computer camps also attract mostly boys, as do computer programming courses from preschool through high school. Does this means that girls are less interested in computers than boys are and less adept at working with them?

That's the conclusion of some educators, a conclusion that puts women at a disadvantage in the schools and colleges of today and the world of tomorrow.

It is estimated that by the year 1990, microcomputers will be a primary work tool in a quarter of all jobs and that 10% of U.S. households will own them.

It is true that fewer women than men enroll in freshman computer courses in college and those who do don't do as well as most of the men. But Kiesler, Sproull and Eccles say this fact can't be attributed to gender differences.

The few men who fare poorly in computer courses are those who have never played computer games or had previous experience with computers. That's a little over a quarter of the men who enter college but almost half the women. The researchers have found that it's the students who have played games in arcades or been exposed

in other ways to hands-on computer experience who do well in computer courses in college.

In this computer age, why have so many women missed out on an opportunity to learn about computers? It's not because girls aren't interested in computers, researchers say. Rather, the computer industry hasn't been much interested in girls.

In arcades and in the school room, most computer games involve male sports, violence or war and appeal primarily to boys.

They have such names as "Major League Baseball," "Tank Command," "Torpedo Terror" and "Hellfire Warrior." They are also displayed in covers showing 28 men for every four women.

The researchers also found that when preschoolers were asked what games they played with, computers were mentioned as toys for boys but not for girls. In kindergarten classrooms equipped with computers, boys monopolize the computers if allowed to.

The researchers suggest that if computer games and lessons were designed for girls' interests as well as boys', girls would be attracted to computers and learn them as readily as boys do. Until that happens, educators and the computer industry will be guilty of handicapping little girls for life in the world of tomorrow.

Counseling by computer

Have you wondered or despaired about what your home computer could do for you? You don't keep a budget, so that's out. You prefer to write letters longhand, lying in bed. You make up your grocery list as you run out of things, writing what you need on a pad on the kitchen wall. Your accountant figures out your income tax from the bank stubs you present to him or her.

Well, despair no longer. Counseling by computer has come of age. It may or may not be what you need. It has not yet been tested and accredited by organizations such as the American Psychological Association.

Software computer programs promise to help you cope with stress, deal with depression, improve your relationship problems — for instance, snag the girl or boy of your choice or keep your wife or husband faithful. There is software for other relationships too — with friends, neighbors, relatives, children and former mates — and more programs are being developed every day.

Kids speak out: 'Computers can be good or bad'

The following thoughts and feelings about computers were solicited from fifth- and sixth-graders at the Maple Wood Elementary School in Somersworth, N.H.

Computers can be wrong because people can be wrong, and people program computers. Especially when there are so many millions of microchips, how can each one be perfect?

I think computers are good and bad. I think they are good because they help people solve problems fast. And bad because people rely on them too much.

DAVID LEON

Computers can be good or bad, depending on how they are used. Computers can be made to do anything, such as to help us with jobs, homework, world matters, medical discoveries and problem solving. For example, computers can also be used by an engineer or a technologist. Computers can help you with homework. Computers could also help solve world problems, if all countries would cooperate.

Computers could be the best time-saving thing in the world. A computer is one of the best resources in America.

BRIAN HEBERT

A computer has no brain of its own. It relies on floppy disks, cartridges and tapes. A computer is a machine just like a car, truck, radio, iron and so on. I think if humans program computers, and humans can make mistakes, then a computer can make mistakes also.

Some people rely on computers so much that if it makes even the slightest mistake they could lose their job, or something else might happen that might change their life.

When I grow up I went to be a naturalist and I'm going to use computers, but I'm not going to rely on them totally.

TOMMY BIRMINGHAM

There really is no problem a computer can't solve, that is, if you put the right stuff into it.

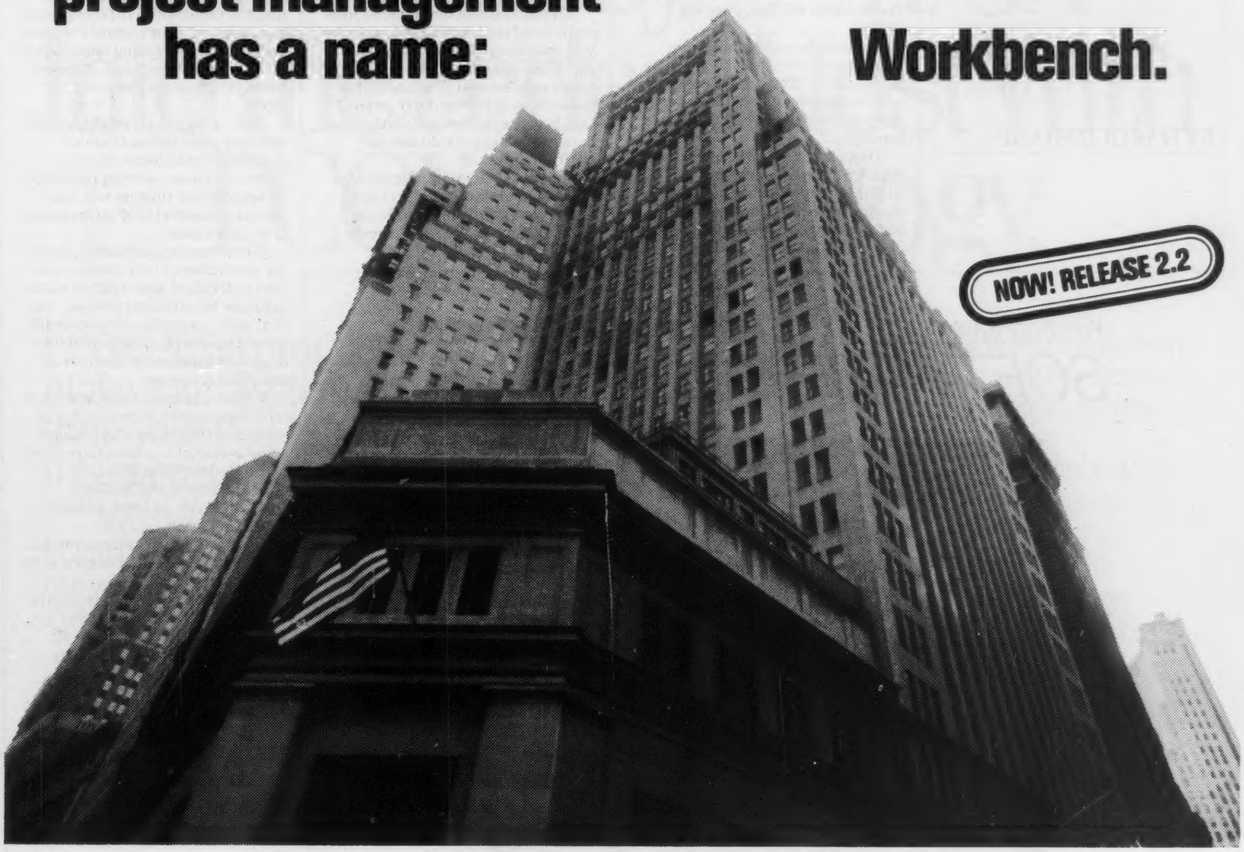
The computer itself can never be wrong, but the person who operates it can. Like when you put in a misspelled word or a wrong sentence, the computer knows it's wrong.

Computers can be whatever you program them to be. Like a war computer can be bad with a push of a button, or a good computer can be a computer you might find at a school or a hospital.

Whoever makes the computer can put in whatever he wants. But you have to put in very certain things so the computer can live. It needs a lot of electric stuff that is very small. So if you looked in a computer all you would see is a lot of little parts that looked like nothing, but it really is.

CATHY DREW

At more than half of the top 500 U.S. corporations, project management has a name: Workbench.



Major companies run major projects. And Workbench has the muscle to make sure the big ones don't get away.

Workbench gives you "what-if?" capability with response time so fast, you can evaluate many schedule changes and compare their effects in seconds.

Workbench alerts you to staff overload, and automatically reschedules your project to remove it.

Workbench includes full text processing, so you can combine a progress report and your own comments to create a single persuasive presentation document.

Workbench permits resource loading across multiple projects. It accommodates so many resources per project and resources per task, you could build the Pyramids without dropping a brick.

Workbench is backed by an unequalled range of corporate support services. Project management training seminars. User groups. A regular newsletter. And a full-time hotline with an experienced consultant at the other end.

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Educated foresight

BY HAROLD SHANE

The silicon age into which our planet is moving requires significant changes in our modes of teaching and learning. A number of desirable educational innovations have been proposed in a variety of publications, such as *A Nation at Risk* (1983), compiled by the National Commission for Excellence in Education, and the Carnegie Task Force report, *A Nation Prepared: Teachers for the 21st Century* (1986).

There is, however, one point that has not been adequately mentioned in the literature. This is the need to develop in *learners of every age* a quality I shall call "educated foresight."

This foresight is one by means of which people can move beyond the silicon-stimulated information society and achieve an applied knowledge society. This is particularly important because of our need to cope intelligently with information overload, sometimes called "infoglut."

The seriousness of the problem was stressed by Professor Daniel Bell of Harvard University, who recently estimated that the rate at which our information is accumulating is likely to double every two years beginning in 1992.

The attainment of educated foresight involves creating policies that will enable us to convert information from our computers into intelligent policies and practices. This conversion is particularly important because computers neither understand what they do nor care about the product.

Unless artificial intelligence fulfills certain remote and perhaps unlikely possibilities, warm, caring, humans with foresight seem certain to remain crucial elements in the societies of a planet with the capacity to destroy itself in a nuclear Armageddon — a Day of Judgment too dreadful to contemplate.

Educated foresight must encompass an understanding of present and potential problems on the world scene, the revolutionary tempo of rapidly changing societies and the implications of our silicon-age ingenuity, for instance with respect to the increasing importance of the roles of computer-directed robots in the workplace and the home.

Achieving the foresight we desperately need means that our schools must become creative learning centers serving people of all ages rather than merely function as repositories of information from times past.

Furthermore, our rapidly growing stockpiles of knowledge mean that individual and creative learning must be a lifelong process, one that helps us continually to understand the complexities and policy decisions inherent in such conditions and issues as:

- The increase of international interdependence mirrored, for instance, in the roster of African dilemmas stretching from Cape Horn to the Mediterranean Sea.
- Shifting world markets.
- The birth, in 1986, of the 5 billionth human.
- Militarism, disputes over disarmament and ways of coping with endemic terrorism.
- Threats to the unique nature of the Third World's cultures.
- A U.S. debt in excess of $2 trillion plus vast debts owed by many developing nations.
- Medicare costs of $1 billion per week, one third of which is used to sustain temporarily the terminally ill.
- Increasing adult illiteracy in America, with an estimated 17 to 21 million people unable to pass a basic literary test as of May 1986, according to the U.S. Census Bureau.

'Anticipatory hindsight'

The eight points above are but a tiny sample of the developments mandating the need for educated foresight. We also obviously need the skill of "anticipatory hindsight." Here I refer to learning from the spectrum of developments in recent years so that our hindsights also help us to anticipate sound future courses of action. We should be able to avoid repeating past errors reflected, for instance, in faulty water and land use or in our pollution of the atmosphere.

To sum up, let me say that a decent, humane future, perhaps our very survival, depends on our developing a new kind of IQ, a high "Information Quotient," that is constantly updated as our accumulating computerized information becomes knowledge and — hopefully — is transformed into the wisdom I believe can be fostered through educated foresight.

Shane, a Distinguished Rank Professor at Indiana University, wrote Teaching and Learning in a Microelectronic Age, *being published this month by the Phi Delta Kappa Foundation.*

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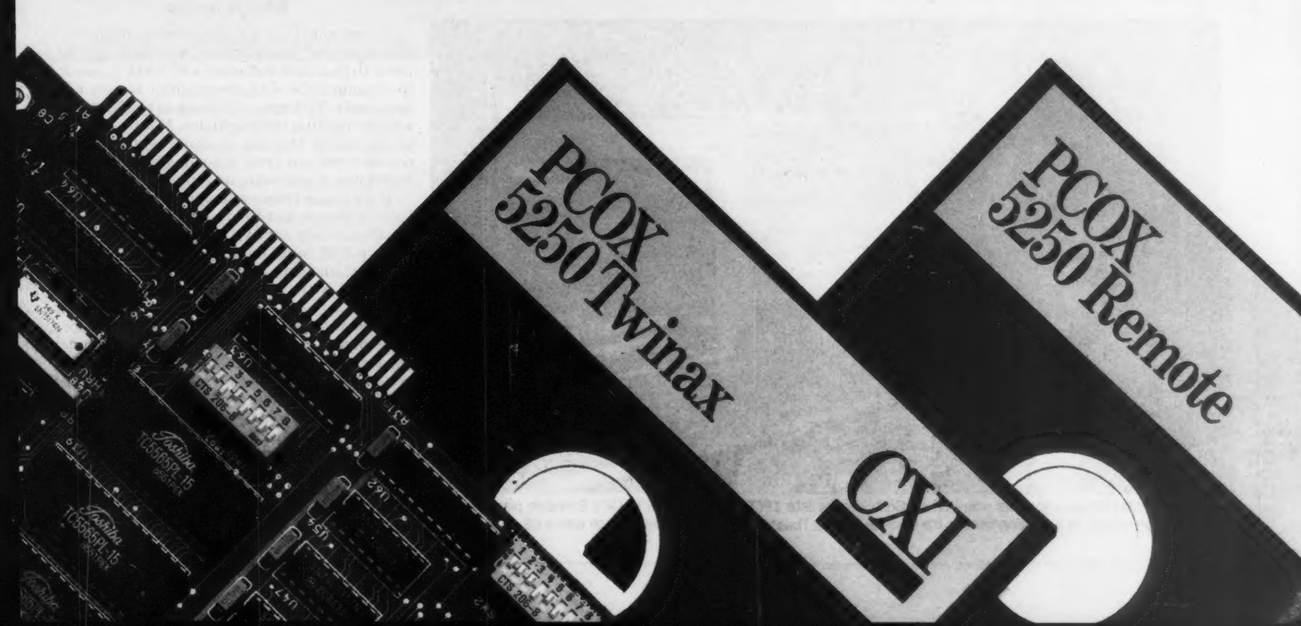


COMPUTERS AND TECHNOLOGY

Machines may think better than, but never the same as, humans

BY HERBERT GROSCH

We are promised miracles of computer intelligence — real voice recognition, automatic expert system production, natural language analysis and synthesis. The enthusiastic proponents admit that superb machines will be needed but claim with some justification that limits on hardware performance are not in sight.

Speed of signal propagation not enough — 10 whole picoseconds to span a chip? Go to a parallel computer with 100, 10,000, a million processors. Runs too hot? Dunk the whole thing in liquid nitrogen. Inadequate communications? Use a bundle of optical fibers as big as your wrist.

Except in very private conversations, these enthusiasts don't predict sentience: Don't promise us a HAL that will discuss last night's date along with today's stock market strategy. Even there, the far-outs of what I have christened the "perceptron school" hope that if you interconnect enough trillion memory units and exercise them in contact with the outside world, something with awareness will develop. It won't be quasihuman, but it will be an intellect, a free thinker.

Well, we never did duplicate bird flight, did we? A hummingbird hovering, a cormorant plunging, a hawk soaring still fill us with wonder. But we built 747s and flying-crane helicopters and Concordes and sent a messenger out beyond Uranus. In a very real sense, our creations fly far, far better than birds. Can other creations of ours, in a similar way, *think* better than humans?

Few computer professionals doubt that some day soon, a computer will be acclaimed as world chess champion (they know that what counts most is not the hardware, but the chess strategies and tactics and the programming skills of the humans who wrote the software). We expect medical diagnostic programs that will be more effective than any one human doctor, because they combine and correlate the expertise of dozens. Contemplate air traffic control or airline reservation systems without computers.

So we should have continuous-speech voice recognition and full natural language processing any day now? Wrong!

There is another fundamental limit besides the speed of light and the laws of heat dissipation. It is the enormous gap between human language and machine language. Human problems are expressed in human language and answers useful to humans, likewise. But down inside the wonderful machinery, the analysis of the problem and the synthesis of the answer must be done in zeros and ones: in machine language.

Human language is flexible, imprecise, redundant, constantly changing and evolving. Computer language is rigid, exact, sparse, permanent. To translate back and forth between the two is to program — a *human* skill. The translation is done slowly, painfully and imperfectly; it is astonishing that it can be done at all.

Programmers, and especially the really good programmers, are prized beyond rubies by research directors and systems managers and knowledgeable chief executives.

PHOTO COURTESY OF THE CHARLES BABBAGE INSTITUTE

President Ronald Reagan appears with Herbert Grosch in the late 1950s during a tour of GE's Evendale plant. At that time, Reagan served as a spokesman for the General Electric Theatre on television and Grosch was a GE employee.

Bridging the gap

We are told that the gap is being bridged, that some day programmers will no longer be needed, that new software will make it possible to communicate with the machine simply and painlessly. Perhaps — but not in the lifetime of anyone reading these articles, I think. The bridge across that gap is of necessity being cantilevered out from our side, from shaky foundations and without good blueprints.

If we could freeze a language tomorrow, as Latin is frozen and Hebrew was once frozen, all the linguists in captivity and all the programmers in IBM could not reduce it to a set of logical statements. And that is a trivial task compared with doing it for living, evolving English.

After that, we have to allow for context dependency: the fact that the same word or phrase or even sentence may mean something in a science and something entirely different in politics, for example. And even more impossible, all this has to be embedded in the broad map of human experience, the steadily growing data bank that warns us that a piece of perfect language expresses a nonsensical idea — or that a nonsensical paragraph is all right because it was intentionally metaphoric or fantastic.

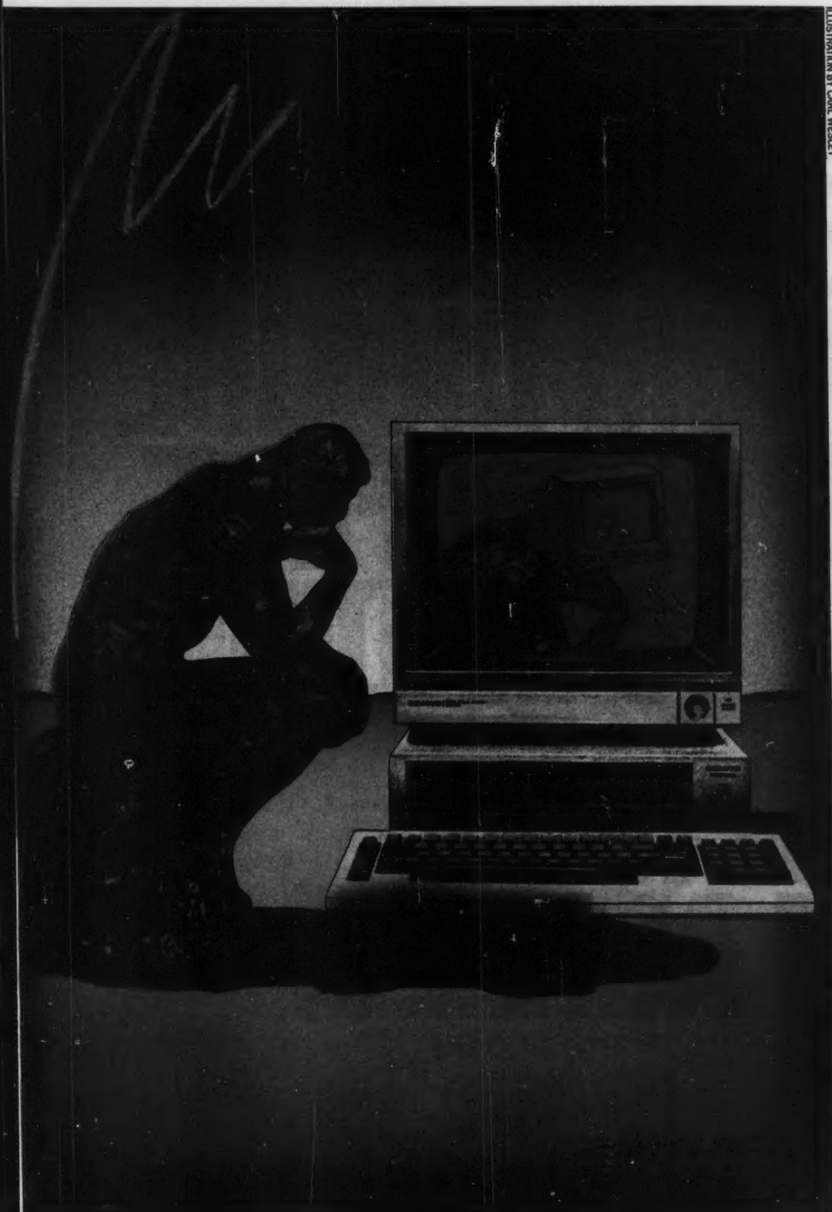


ILLUSTRATION BY CARL WESLEY

Sounds impossible, doesn't it? Yet humans do it every day — yes, every minute. That is why they can write programs, and computers without humans cannot.

And even this skill pales besides that of the poet, who can evoke a whole universe with a few stanzas or a single phrase like "Not with a bang but a whimper."

We cannot disregard the laws of physics, and equally we cannot ignore the complexity of human thinking and natural language. Software will continue to be inadequate, messy, expensive and full of bugs. Programmers will continue to be essential. Bridges across the gulf between man and machine will crumble as their foundations and their designs prove inadequate. Software is often impressive; hardware is usually magnificent. But the minds that produced them and the minds that link them to the world — they are the ultimate marvel!

Grosch is known for the relationship (Grosch's Law) between computer speed and cost, which he discovered in the early 1950s. He has worked twice for IBM, twice for General Electric Co. and twice for the federal government, most recently as director of the Bureau of Standards Institute. He lives in Europe and consults for companies there, in North America and in Japan.

HANDS-ON

Recreating the 'Star Trek' story

Gene Roddenberry produced the television show. Diane Duane wrote several books, carrying on the adventures of the ship and its crew. Then Simon & Schuster, Inc. paired Duane with a software firm called Micro Mosaics Productions, Inc. in New York City to produce a "Star Trek" story in a hybrid form that would allow a fan not only to board the ship but also slip right into Captain Kirk's uniform and direct the action.

"Star Trek: The Kobayashi Alternative" could be called a computer adventure game but, given its lack of graphics, it is in fact more like an interactive book — an adventure text that lets the reader influence the twists and turns of the plot.

Interactive texts weren't born with Simon & Schuster's release of its "Star Trek" title. There have been other software packages that read like books and respond like games, probably most notably the mystery releases from Infocom, Inc. of Cambridge, Mass. But Simon & Schuster is a book publisher and "Star Trek: The Kobayashi Alternative" has proven to be something of a blockbuster since its release in the fall of 1985. It made software bestseller lists, though not *The New York Times* book list, with 100,000 copies sold in the first eight months. According to Lesli Rotenberg, publicity manager for the Computer Software division of Simon & Schuster, it found its way into libraries, bookstores, computer stores, software stores and general merchandise outlets.

Simon & Schuster is planning to follow up this success with another title release this fall. In the meantime, the collaboration between Duane and the programmers at Micro Mosaics also continues along other veins. Programmers at the software company are working with her on translating another of her books, "So You Want to Be a Wizard," into an interactive computer text.

According to Larry Rosenblatt, president of Micro Mosaics, the "Star Trek" text has more in common with a novel than a computer game. Not only does it have long descriptive passages, he says, but it has a beginning, middle and end, as do all but the most experimental of novels, and it is divided into episodes that are equivalent to chapters.

"The Kobayashi Alternative" also broke form with adventure games, Rosenblatt says, in terms of its audience appeal. Computer games draw mostly males, he says — teenage boys and men over 30. This interactive adventure text also found favor with girls and women.

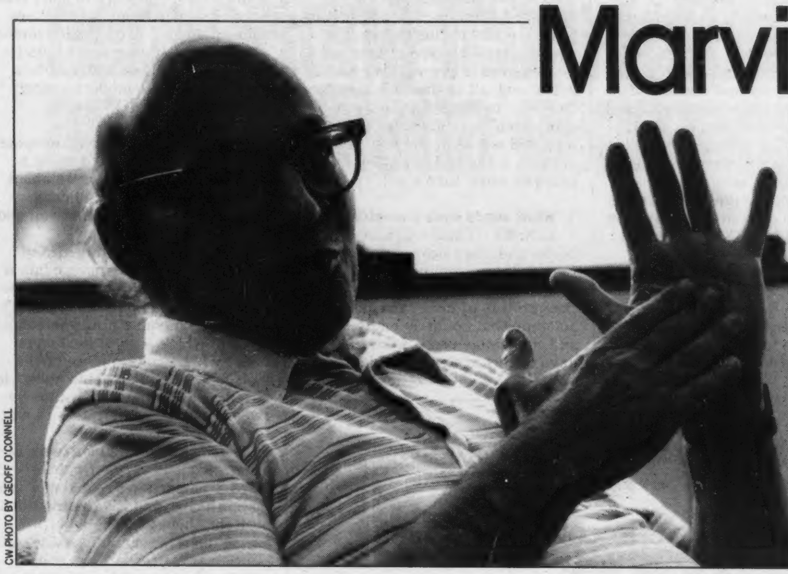
Rosenblatt has a lot of ideas about books that would translate well onto the computer screen. He is convinced that interactive text adaptations of books could help to raise reading levels by making the process more accessible to people who fear its complexity.

And people who get used to reading from screens could start reading other things too. "If people can get to know stories and characters in a less threatening way than picking up a book may seem to them," he says, "they may even wind up getting so interested that they'll look up the original source."

....

" *The computer is about to achieve much of what Esperanto tried to accomplish: acceptance of an international language. Much of the information stored in one language can be retrieved in another. U.S. and Russian computers can be programmed to talk to each other without translators or trust in each other.* "

JOSEPH EATON
from *Card-Carrying Americans*



CW PHOTO BY GEOFF O'CONNELL

Marvin Minsky

Pioneer of AI — making machines do what they can't do yet

MIT Professor Marvin Minksy helped organize the Dartmouth Conference in 1956, where the term "artificial intelligence" originated. In 1960, he founded the Artificial Intelligence Project at MIT with John McCarthy.

Among his writings is a paper written in 1975 called "A Framework for Representing Knowledge," which set forth the concept of using frames as structures for organizing knowledge in natural language and vision systems. Computerworld *Senior Writer Michael Sullivan-Trainor interviewed Minsky at his MIT office on the present and future potential of machine intelligence.*

A definition of artificial intelligence that is attributed to you says: "AI is the science of making machines do things that would require intelligence if done by men." Do you still agree with your definition?

MINSKY: Well, I don't believe in definitions. But people seem to want them. AI is making machines do things that they can't do yet, and people use the word intelligence for it. It seems to me that intelligence is just the things that people do that they can't explain, so it's not a thing. It's a way to solve problems.

What's the difference between human intelligence and machine intelligence?

MINSKY: Well, there can't be any if you believe that a human is a particularly complicated kind of machine. But the class of machines is very large. We're made of a trillion connections between cells, and someday we'll make other kinds of machines with billions of connections, and they may do different things. So psychology is part of AI.

Are there any machines that one can say "think" now?

MINSKY: Thinking is a matter of degree. Some machines solve problems that people find hard. There are lots of things machines can't do yet. No machine can tell a cat from a dog by looking at it, and really no one knows how hard that is. When finally it's done, it might turn out to be easier than people thought.

What is your criteria for measuring when it could be said that a machine can think?

MINSKY: There isn't any. It's like saying, How can you tell when something's alive? You look at a strand of DNA — some people would say it's alive, others would say something else. It's not a clear-cut thing. There won't be a point at which machines suddenly think. They'll get more and more mind like.

Without definitions, how can you set parameters on artificial intelligence?

MINSKY: You just look at hard problems like making a machine read a book and explain what it's about, or telling a dog from a cat or figuring out how to fix something that's broken.

There are lots of problems to work on. You don't worry about making rules about it. Until you understand the thing, you can't make very good rules.

What's the most advanced or intelligent machine that exists now?

MINSKY: There isn't any scale. There are machines that do things that surprise people. Many years ago we made a program that solved problems of calculus, and at that time, it got an A on MIT calculus exams. This was very surprising because people thought of calculus as one of the great achievements of the human mind, and it turned out to be possible to do that well with a system that was basically one of the first expert systems, based on a couple of hundred rules.

It was a revelation that a skill people thought was very advanced, requiring a lot of intelligence, was so simple. It turned out to be easier than making a program that could do simple assemblies of parts. And making a machine that can see the things that every child can is still beyond us.

Our judgment about what's easy or hard depends on what we ourselves are equipped to do.

Things that seem simple to us, like recognizing objects, require tens of billions of neurons in our brains; and doing things like college calculus probably require very tiny portions of our brains.

It's harder to get machines to do the things we do without knowing how we do them. I think in the next hundred years, we will separate the things that seem simple, and are, from the things that seem simple because we inherit tremendous computers in our heads specialized to do those things.

If you could forecast the next five or 10 years of artificial intelligence development, what are some of the problems that will be solved?

MINSKY: Well it's very hard to predict how long anything will take, because if you knew how long something would take, that would be because you have a plan of how to do it. Getting machines to learn to use language is something that is going to move rather steadily over the next generation, and it's difficult to predict what problems will be encountered.

People are trying other ideas about making the machines learn, such things as not concentrating on the structure of the language itself, but instead on how we learn. This movement, called connectionism, has become very attractive because it's connected with learning rather than programming.

It's a wonderful idea that if we can make a machine that has very broad learning capabili-

ties, then we don't have to do all this nitpicking programming anymore.

What is your theory about how these problems can be solved?

MINSKY: It's called the "society of mind" theory.

The theory says there are some parts of the brain that are specialized to do particular things, like recognize the edges of objects and recognize certain wave patterns and sounds and so forth. These are the lowest level ingredients that you would need for vision and for speech.

But then you'd need other parts of the brain, which I'd call agents, that learn from experience which of these specialized parts are useful to pay attention to. And, you'd have yet other agents that learn which of those to use in various circumstances.

How does this apply to the structure of a computer system?

MINSKY: It would mean instead of programming each of the parts to actually solve the problem you want, most of them you would program to crawl around inside and look for other parts that are doing these little subjobs. Almost all of this decentralized computer would be each part trying to improve its way of managing others.

What people do now is try to put knowledge in computers about how to solve a problem. The important thing is knowledge about the knowledge, knowing which kinds of knowledge are useful for which kinds of jobs. Of course, somewhere you have to have little bits of knowledge to know how to do some jobs, but most of it is administrative, knowing how to keep the thing from going wild.

A lot of the knowledge is negative — noticing that certain patterns are unproductive and factoring them out. In this theory, half of the programs are about what not to do, whereas in present-day programming, all of the code specifies things to be done. On the whole, there aren't any pieces of code that look and see what the rest of machine is doing and say, "That's not going to work, turn it off."

What would such a machine do?

MINSKY: It might be able to read books and learn how to do things. I'm not interested in particular applications. But this is in answer to the question of how you could get a machine that could do many things and coordinate them. Like now we have expert systems for playing chess and for designing transformers and reading oil well logs, but if you switch one over to another application, you have to start from scratch again. What we need are administrative parts, which understand how to adapt specialists for other applications. It would be a long path. There might be other approaches, too.

In some of your past statements, you've talked less about using a machine as a tool and more about the merger of people and computers. Is that something that you still think is a possibility?

MINSKY: There's this idea of transferring your structure into a machine that won't break so often. Of course it's a possibility, but it's certainly not something you can do right now. It's a great deal more theory. It's a consequence of the idea that what a machine knows is based on a set of relationships between its parts, and it doesn't matter what the parts are.

This downloading idea to me and other people is very straightforward. The parts we're made of are insignificant, and it's the relations between them that are what we are, and so that could be made out of other things. There are other people who think it's very important that these parts be made out of carbon and nitrogen, rather than silicon and phosphorus. I think they're silly, and they think I'm silly and these two views will always talk past each other.

It seems that the view that the parts are important is related to the idea that we're made in God's image and you shouldn't tamper with that.

MINSKY: It goes to the religious idea, which I never understood, that if God wanted you to do something, you should do it, or if he didn't, you don't. What does your origin have to do with what you should do? It's not clear to me.

If the chimpanzees had been smarter and saw humans coming, they might have said, "This is great; we're going to become better," and others might have said, "This is terrible; we're going to be replaced." That distinction is meaningless if you look at the stream of evolution. Everything is descended from something else, and it's just a semantic thing to say, "I've been replaced."

Then the future could go one way — where there is this merger of man and machine, or it could go another — where machines are exclusively tools and separate?

MINSKY: Or it could go a third way — where we regard them as our descendants. Isaac Asimov explained in a recent lecture at MIT that the sensible thing would be to go in the direction of making them tools. Most people have to do things that aren't fit for the human mind. The proper role of machines at least for the near future is to allow people to be intelligent again, instead of doing the kinds of things machines could do.

Of course, he's taking a narrow view of what machines could and should do. As they become more capable, then it becomes more and more of a problem about whether we should make our own competitors or whether we should regard them as us.

COMMENT

It has been exciting and gratifying to be a part of the personal computer revolution, especially through my affiliation with Tandy Corp.

There is no question that personal computers have changed the lives of each and every one of us, directly or indirectly. PCs are being used to make businesses more efficient, people more productive and students better educated. They have served as tools, toys, curiosities and even status symbols. Prices have tumbled, while capability has advanced by leaps and bounds. But where is it going?

The permanence of any product lies in its utility to businesses, institutions and individuals. Personal computers have spawned some of the greatest excitement, strongest hype and wildest enthusiasm of any new product in our lifetime. But they have also provided more true utility and benefit than most products ever do, assuring it a permanent and prominent place in society.

Schoolchildren are being trained in computer literacy. PCs are becoming standard fixtures in businesses. Future generations will be as at home with them as we are now with telephones and pocket calculators. And I expect the PC to take a similar position as a commodity product for business and home, wherever it is found to be useful.

In fact, I think we're seeing a maturing marketplace already. More PCs are being bought now — as they should be — as tools to help people perform useful functions faster, more accurately and more efficiently.

Traditionally we have thought of a tool as something to multiply physical strength. Computers multiply our mental capability to manage and analyze facts, data and numbers.

Long after the hype is forgotten, we will still be producing, selling and supporting personal computers as one more product of technology that makes our lives more enjoyable — and gives us more free time to learn about and enjoy the next high-technology wave.

JOHN ROACH
Chairman, Tandy

The second Industrial Revolution

BY RAYMOND KURZWEIL
Chairman, Kurzweil Applied Intelligence, Inc.

During the 18th century, industry — and society — were transformed by the introduction of machines that could extend, multiply and leverage our natural physical endowments. It became known, of course, as the Industrial Revolution.

Today, a second industrial revolution is in progress. It was brought about by the introduction of computers — machines that extend, multiply and leverage not our physical but our mental powers.

Some of the same controversies that cropped up at the time of the first industrial revolution are appearing again. But now, a new and more profound question emerges.

While we have always regarded our species as relatively mediocre in physical prowess, that has not been our view with regard to our mental capabilities. The name we have given ourselves — homo sapiens — defines us as the "thinking men." The primary distinction in our biological classification is the ability to manipulate symbols and use language.

Before Copernicus (1473-1543), our "speciecentricity" was embodied in a view of the universe literally circling around us in a testament to our unique and central status.

Today, our belief in our own uniqueness is not a matter of celestial relationships but of intelligence. Evolution is seen as a billion-year drama leading inexorably to its grandest creation — human intelligence. The spectre of machine intelligence competing even tangentially with that of its creator once again threatens our view of who we are.

Far greater impact

The current revolution, based on machines that expand the reach of our minds, will ultimately have a far greater impact than the revolution that merely expanded the reach of our bodies. It promises to transform profoundly production, education, medicine, aids for the handicapped, research, acquisition and distribution of knowledge, communication, the creation of wealth, government and warfare.

The cost-effectiveness of the key ingredients in our new technological base — electronics, computers and the sophistication of computer software — is increasing at an exponential rate. The power of computer technology, for example, now doubles (for the same unit cost) every 18 to 24 months.

Unlike some political revolutions, this latest transformation of our industrial base will not arrive or even culminate in one brief period of struggle. It is a gradual process, one already under way. The potential exists to address problems that have burdened the human race since the beginning of recorded history.

Consider, for example, the application of computer technology to the needs of the handicapped. The potential exists within the next one or two decades to ameliorate greatly the principal handicaps associated with the major sensory and physical disabilities, such as blindness, deafness and spinal cord injuries. New cost-effective intelligent computer-assisted instruction systems could sharply reduce illiteracy in underdeveloped nations. New bioengineering techniques that rely on expert systems and computer-assisted design stations for biological modeling could be the key to effective treatments for cancer, heart disease, mental illness and other categories of disease. The increase in real per-capita wealth — 600% in the past 100 years — is expected to continue.

But the potential for danger is also manifest. Today, we are rapidly turning over our engines of war to intelligent machines. Their intelligence may be as flawed as our own. Computer technology is already a powerful ally of the totalitarian.

The advent of intelligent machines is altering global trade relationships. There are many implications of computer-based technology underlying this second industrial revolution that have a bearing on national policy and our nation's future position in the world economy.

For example, this new technology uses almost no natural resources. Silicon chips consist of infinitesimal amounts of sand and other readily available materials. They require insignificant amounts of electricity. As computers grow smaller and smaller, the material resources utilized are becoming an inconsequential portion of their value. Indeed, software uses virtually no resource at all.

With the use of natural resources and energy reduced to a minimum, the value of this technology is in the knowledge governing its design. Thus, the environment comprises designs of hardware, software and data bases that make up our intelligent machines and the brain power to continue advancing these designs. This decreasing importance of material resources has allowed Japan, a country very poor in natural resources but rich in knowledge and expertise, to prosper. There is the potential for emerging nations to skip industrialization altogether and develop postindustrial societies based on an information economy.

Knowledge, then, will prove to be the "new wealth of nations."

The revolution manifest in this new age — this age of intelligent machines — is in its earliest stages. The impact of these new machines that augment our mental resources will be greater than the radical technological and social changes that have come before. It cannot be stopped. Today's challenges are to be found in our need to understand it, to learn to live creatively and harmoniously with it and to harness it to constructive uses.

Mankind, computers and communications

BY KOJI KOBAYASHI
Chairman, NEC Corp.

I have long thought that communications technology could not help but merge with computer technology eventually and that information transfer and information processing are inseparable. Around 1975, my mind was filled with C&C, the integration of computers and communications, although I did not speak out then.

The advance of semiconductor technology to integrated circuits and large-scale integration at that time was eye opening. I predicted that this tendency would certainly bring epoch-making changes to both the fields of computers and communications. As anticipated, the digitalization of communications systems was greatly spurred. I understood that communications technology would become homogeneous with computer technology. In other words, the technological base for the merger of communications and computers was forming.

In 1977, I presented the idea of computers and communications technologies as moving toward integration at the Intelcom '77 show held in Atlanta. In 1978, I delivered a keynote speech at the Third U.S.-Japan Computer Conference, held in San Francisco, using the term C&C.

As we entered the 1980s, I felt that C&C made a new step forward. In considering C&C, it became necessary to give thought to the human aspect in addition to the technological one.

Humans are users of information via C&C systems. At the same time, they must be seen as the bearers of C&C systems development. To paraphrase the admirable sentiment of Dr. Jerome Wiesner, president emeritus of MIT, the most important concern we have in considering the information age is the relationship between humans and machines.

I named this relationship "man and C&C" and think that it is the indispensable element if humans are to utilize C&C freely.

In 14 more years, we will enter the 21st century. There are many views on prospects in the 21st century. However, they all aim at the realization of the advanced information society.

I anticipate that various C&C-related technologies will be realized in the remaining years of this century and that C&C systems, endowed with intelligence by their software, will be built on a global scale. And I predict that in the next century, C&C systems, as global information communications networks, will cause changes in the information environments, as water permeates the soil, to bring about changes in one industrial structure, give birth to new industries and provoke changes in the social structure.

Thinking so, I cannot help feeling that we are now coming to a time of historical shifts in our civilization. Human history has seen

I have a dream: to realize automatic interpretation telephone systems through which anyone in any part of the world can convey his intentions beyond the difference in languages.

agricultural society, using livestock and natural forces as tools, give way to industrial society based on harnessing and using energy. Here, industrial technology has replaced human physical labor, rapidly increased social production power and brought about various changes in our social systems. In short, technological innovation has brought forth both economic and social change.

What then will be the motive power of the 21st century, a society we assume as an advanced information society? It has been pointed out that information will be an important economic resource, together with capital and resources. I think that information will have a larger influence in economic and industrial activities, corporate management and social life in the 21st century and that the tools for conceiving, developing and maintaining the information environment will be C&C.

As it unfolds, C&C will first become a global-scale information-related infrastructure. Second, the information infrastructure will become the tool for solving a variety of problems, promoting further economic and cultural development and advancing mutual understanding among nations. Third, by effective use of information resources, other resources hitherto inaccessible or uneconomic will come to be

developed. This advanced information society, supported by C&C, will not suddenly appear one day, but we should understand that changes toward it have already started.

There are now new developments in Japan, such as the introduction of the value-added network business and new common carriers as well as entry into information communications fields by different industries. As the information environment matures, people will move and choose information by using the large-scale C&C systems, with C&C terminals serving as the human-machine interface instead of moving themselves or materials.

Home shopping, banking, consultation and education will become a matter of course. Dispersion of plants on a global scale, which we anticipated 20 years ago, will further spread as information gaps between regions and the barrier of distance disappear.

Point-of-sale terminals at supermarkets and retail stores and automatic systems for debiting on purchase have already started. There will be a strong possibility of an entirely new industry being born, concerned with controlling information.

I take it that the movement toward C&C, in this wide sense, will be a central trend in electronics in the remaining years of the 20th century, and I remain confident that it will continue to develop as we move toward the year 2000.

Finally, I have a dream: to realize automatic interpretation telephone systems through which anyone in any part of the world can convey his or her intentions freely, beyond the restrictions of the difference in languages.

I think this automatic interpretation telephone system will be able to come about based on C&C technologies. I firmly believe that this system will be the best gift to humankind, to remove national boundaries and bring everlasting peace.

....

“We can confidently postulate more tactile and graphic computers of exceptionally low cost. Similarly, we can picture users ranging from children to adults, delighting in the mannerisms of something like an electronic finger painting. We can imagine the performing and visual arts drawing closer together, designs becoming more ephemeral, and every man an artist.”

NICHOLAS NEGROPONTE
from “The Return of the Sunday Painter”

Technology: Invader or protector of privacy?

BY SANFORD SHERIZEN and GARY MARX

Business executives seldom consider privacy a pressing issue. If they pay attention to it at all, they view privacy as a matter of protecting corporate proprietary information. Executives less often consider the right that employees, customers and clients have to be free from the collection of unwarranted personal information.

In truth, we may have less privacy today than we did in the symbolic year 1984. Technological advances that George Orwell could not have foreseen have opened up new opportunities for highly intrusive, inconspicuous invasion of privacy. What contemporary commentators have not sufficiently explored is the idea that technology can also be used to protect privacy.

Corporations have generally not taken forceful action to protect either corporate or personal information. Now, privacy has once again become a matter of congressional and public interest. How technology is ultimately used will depend largely on how corporate and government leaders make decisions. Action with respect to the privacy issue rests on the awareness and concern of nontechnical upper level executives.

Nebulous threat

Privacy is one of those intangible concepts that is easy to support in the abstract but difficult to make workable in concrete terms. The best understood threats to our privacy — misuses of credit or health data and government snooping on individual citizens — are easy to see. The less well-understood threats are, in some ways, more threatening; the public may

not know about them, but such threats slowly chip away at what we assume is inviolate protection of privacy and freedom.

Consider the following examples of how information has become more exposed, requiring active corporate protection of privacy and adequate security for confidential data files:

■ Because of increases in employer contributions to worker health plans, programs to control the cost of corporate contributions have led to increased corporate collection and use of employees' highly sensitive medical and mental health information.

■ In an attempt to increase productivity, corporations have increased the monitoring of computer and telecommunications usage by employees.

At times, this results in private communications being reviewed.

■ To protect corporate proprietary information, some employees are required to sign a waiver of their right to work for a competing firm for a specified period after leaving the corporation, and the corporation may carry out surveillance to determine whether these conditions are met.

These examples suggest the complexity of the task of finding the right balance between corporate practices and privacy rights.

In the process of seeking security, strategic advantage or cost containment, corporations may be violating legitimate privacy expectations.

The failure to pay adequate attention to privacy questions can mean the violation of individual rights and expectations, employee dissatisfaction, law suits and negative mass media coverage.

The Privacy Act of 1974 is the major federal legislation affecting individuals. The legislation, passed during the turbulent era of Watergate and Vietnam, was written to protect against government misuses.

The Privacy Act

The framers of the legislation clearly assumed certain technical and social conditions. This was the era of batch processing — government agencies and large corporations were the major users of computers.

The telecommunications industry was regulated and highly structured; its development and functioning were largely separate from computer systems.

The Privacy Act failed to make adequate provision for the technological changes that have taken place during the last 12 years. One example is the increase in modem capabilities.

The U.S. National Security Agency estimates that all the modems purchased in 1972 could together transmit about 600,000 characters per second. In 1984, a sufficient number of modems were purchased in the U.S. to transmit 220 million characters per second.

The speed of communications has also changed. According to the Office of Technology Assessment (OTA), with increased communications capacity made possible by fiber-optic technology, it is possible to transmit at a rate of 100 average-length pages a second. This could permit the creation of centralized libraries with universal access.

Since passage of the Privacy Act, we have seen the more widespread use of personal computers, network developments, merging of computers and telecommunications systems, deregulation and competition in information services, centralization and integration of data bases, increased speed and storage capabilities, greater system complexities and increased societal dependence upon system reliability.

The legislation, passed during the turbulent era of Watergate and Vietnam, was written to protect against government misuses.

As discussed in a recent OTA report, "Automation of America's Offices," assessing confidentiality in an organization with new decentralized or networked office technologies requires consideration of a number of new factors:

■ Low- or no-security physical environments in offices.

■ An increased amount of finished and refined information in office automation systems.

■ The mobility of microcomputers and their data storage media.

■ Less sophisticated office automation users.

■ Relatively or fully uncontrolled channels of data communications.

■ A wide-ranging ability to add information to, copy or extract information from corporate data bases.

■ Little or no hardware or software security protections.

■ No assurance of how employees will use technical capabilities.

Consider the extent of interconnectivity in the case of one major corporation. IBM's W. H. Murray, in a speech before the 11th Annual Computer Security Conference, noted:

"In IBM, we now have a worldwide network of more than 1,500 mainframes and 200,000 terminals. Any user at any terminal can send a message or a file to any other user. A user can connect to any application in any of those 1,500 systems. Programs and even entire applications spread spontaneously

through the network, usually without management direction or intent and often without management understanding or knowledge. Employees can access the network from their homes. Some vendors and contractors use it.

"DP management did not plan it. They bought it and built it, but they were just as surprised as anyone else when they saw 'what God had wrought.' "

In essence, the Privacy Act has been overtaken by technology. While the act froze, technology continued to grow. The computer and DP industries rushed to develop new products and to find new market opportunities.

Today, the Privacy Act is no longer adequate for the challenges. Other privacy protections are needed. There has been little to replace or to resuscitate privacy protections.

State laws in general are not doing it, worker and consumer groups are not able to do it, and management for the most part does not seem to be interested in doing it.

Many technical solutions to privacy protection suffer from some of the same difficulties that information security does — namely, negative performance impacts, user resistance and avoidance, complex operating environments and lack of product robustness. It is time to rethink privacy protection.

It is also well to note that the privacy issues involving computer data are nestled within a broader set of concerns involving employers and employees. This involves the corporation's desire for continually more informaton about employees. Consider, for example, current controversies:

- Drug testing.
- Medical screening that may result in excluding healthy workers who have a higher than average probability of developing serious illnesses in the future.
- Access to previous employment and arrest records.
- The acquisition of information from companies maintaining data bases on employee health and lifestyle behaviors.
- Video monitoring in restrooms and lounge areas to check for drug use.

In some situations, the justifications for these are clear. Yet it is important to be aware that there is an expansionary trend to collecting and accessing personnel information. In a world filled with uncertainty, it is easy to assume that more data is always better. From a privacy, as well as an efficiency, perspective, that clearly is not the case.

Some difficult questions face corporations when it comes to protecting privacy.

What should and should not be kept private? There are few clear-cut standards that indicate what should be privacy-protected. Some organizations simply use a form of information classification (company secret, company confidential, personnel private and so on) as a shorthand to indicate levels of protection required. However, that is usually not an adequate guide to the types of privacy protection required.

What are the liabilities involved in failing to protect privacy? Liability concerns gain instant attention today. Even with the weakness of the Privacy Act, there are legal ways to challenge privacy violations. Along with sexual harrassment and civil rights violations, privacy violation cases generate media interest and can have serious implications for corporate as well as individual managerial reputations.

What are the technical difficulties in ensuring privacy protection? Many of these are data base issues having to do with data and system integrity requirements. Integrity constraints must be explicit in data models so that information rules can be defined and maintained. Access rules need to be established and mechanisms put in place to support their operations.

In a world filled with uncertainty, it is easy to assume that more data is always better. From a privacy, as well as an efficiency, perspective, that clearly is not the case.

As system linkages develop further, privacy issues will gain more attention. One way to think about these issues is to develop an organizational privacy protection scorecard. This will provide management with a review of how well privacy is being understood and what more is required.

There is increased public concern about individual privacy. Unions, women's groups and civil liberty advocates are raising concerns about corporate and government uses of data. Work monitoring is becoming a symbol for a variety of problems affecting employees on the assembly line and in the office.

Two types of data protection needs are going to have to be addressed. The first is corporate information. This includes certain rights of corporations to be protected from their competitors.

Protecting proprietary information is a leading example. Competitive business intelligence is a growing field, providing firms with tools and techniques to learn about their rivals.

The second kind of data protection to be addressed is employee and customer and client privacy rights. From a corporate perspective, this may be considered a less pressing issue than corporate information protection.

However, a lack of attention to employee and customer and client privacy concerns may result in the loss of essential business factors, public reputation and product acceptability.

Sherizen is a Natick, Mass.-based information and computer security consultant. Marx is an MIT professor specializing in the social impact of communications technology. This article appeared in Computerworld *on July 28, 1986.*

COMMENT

Perhaps the most crucial challenge we face in the next several decades is keeping up with the accelerating pace of change. Increasing advances in microelectronics, as well as continuing development of parallel systems and other advanced architectures, will continue this rapid increase in computing power. At the same time, systems will likely be increasingly easy to use, smaller and less expensive.

The result will be more and more power in hand, either through access to large-scale networks or major advances in personal computing. Technology will also find its way into a variety of consumer products, often in ways invisible to the user. Finally, technology in the form of advanced manufacturing and control must find its way into all of our basic industries.

But there are other areas that will also yield important breakthroughs. Telecommunications, energy, materials science, biotechnology and aerospace will all produce breakthroughs that will affect government and commercial products.

Great possibilities come from the merger of these technologies. Telecommunications advances, combined with advances in information processing technology, will significantly change the way we communicate. New materials will combine with microelectronics breakthroughs to increase the speed and reliability of computers while decreasing their sensitivity to hostile environments.

Ultimately, however, the greatest effect on our lives may be in the way we teach and learn. The incorporation of advanced technology into our educational system holds great promise for assisting teachers in the critical job of educating our young. This new educational system will produce a generation of informed and capable users of technology, and it is this new generation who will discover applications and products we have not even conceived of.

BOBBY INMAN
Ex-president, Microelectronics and Computer Technology Corp.

....

As athletes get closer and closer to the ultimate performance in their sports, they search for any possible way to get an edge on their competition and to maximize their own potential.

Training has often been a hit-or-miss proposition. For example, visionary coaches develop better training methods or more successful programs, often by intuition. There has been no systematic or scientific way to keep the best of what they develop while phasing out ineffective methods or incorporating new ones. Designing and modifying training programs as more and more variables are brought into consideration requires a computer.

I have been involved in the design of a new computer program, called Runningware, that allows runners to design, modify and analyze their running. This program provides tools that allow runners to tailor training programs to their own abilities and goals and provides the means to plan, track, study and improve their running. Rather than impose inflexible workout schedules made the same for everybody, Runningware allows runners to use whatever training regimen or philosophy they choose. Runningware is a very user-friendly program that helps runners of all levels — from the fitness runner to the competitive runner with more complex demands.

I intend to put 13 years of my running records on disks so that I can easily analyze trends in my training prior to successful or unsuccessful races. The computer and this software help me learn things about my training that would be impractical if I had to use pencil and paper. They would take too much time.

Computers have revolutionized almost all areas of our lives; it's exciting that computers are now being used to enhance the performance of all sorts of atheletes. As a runner, I intend to take advantage of computer training applications. I want to have every possible edge!

ALBERTO SALAZAR
Marathoner

....

"Computers now do most of the planning for our wars. It would seem only fair to let them do the fighting, too."

BILL VAUGHAN
from *Half the Battle*

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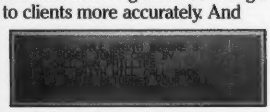

The EZ-Talk telephone's 16-line screen tells you who called, who's holding and who needs to see you.

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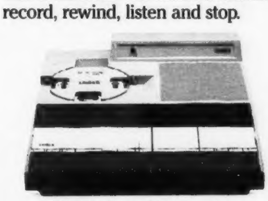
Pocket Protégé puts all the features of a desktop dictation unit in the palm of your hand.

Pocket Protégé lets you give your secretary special instructions before she starts typing. So she won't finish typing a lengthy letter only to find a paragraph you want inserted. So you save her time and yours.

But even though Pocket Protégé is a product of incredibly intricate technology, it's easy to use even if you're all thumbs. Just use one of them to operate the one-button that controls all the main functions: record, rewind, listen and stop.



With the Lanier Messenger four executives can have their own cassette for dictation.

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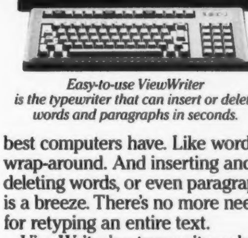
Storing what's been typed has never been easier, either. ViewWriter has its own memory and expandable storage.

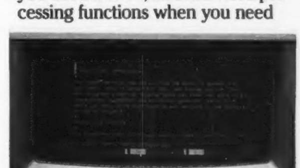
In fact, ViewWriter has all the features of the best electrics and electronics, with many of the time-saving word processing features the



Easy-to-use ViewWriter is the typewriter that can insert or delete words and paragraphs in seconds.

best computers have. Like word wrap-around. And inserting and deleting words, or even paragraphs, is a breeze. There's no more need for retyping an entire text.

ViewWriter's a typewriter when you need it to be, and has word processing functions when you need



ViewWriter's large screen lets you view and edit 16 lines of text.

them. Yet, for all its versatility, it's so easy, your people can learn to use it in less than an hour. So they can be typing away on the very first day. Before lunch.

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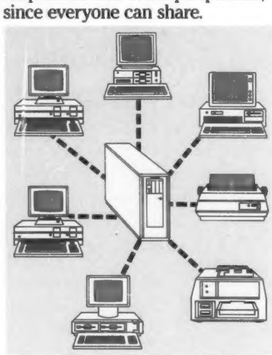

With the new Lanier network, you don't have to learn complicated computer commands to make all your PC's work together.

The Lanier network makes others obsolete because it's so easy to use. And because it's so easy to learn to use with the Lanier Support Staff. They'll have your office completely operational in far less time than it would be with any other network.

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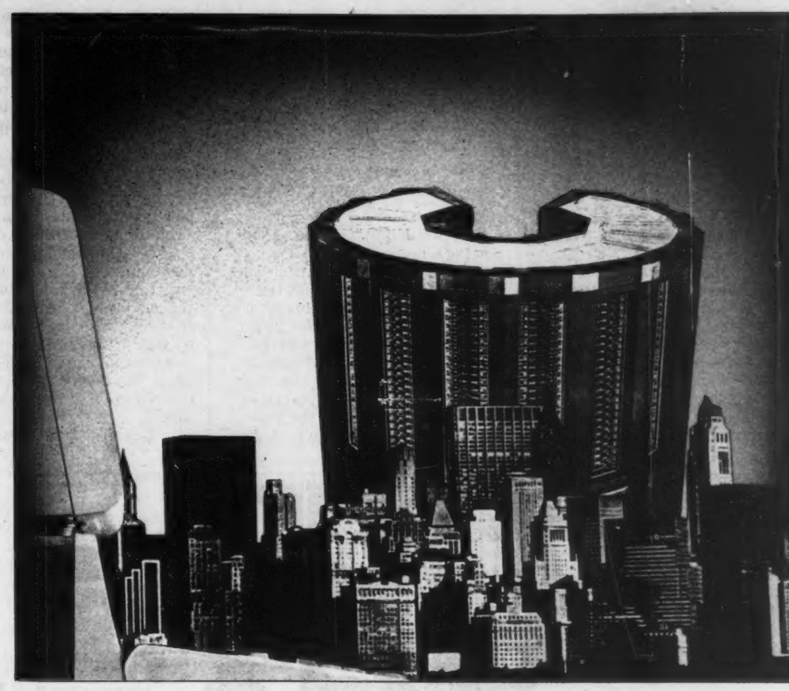


ILLUSTRATION BY CARL WESLEY

BY WILLIAM NORRIS
Chairman Emeritus, CDC

Defining a supercomputer is complicated, and a definition today is less precise than it was even a couple of years ago. In technical publications and in the general news media, we read such terms as "near," "entry" and "affordable" supercomputers and variants such as "Crayettes" and "mini-supers." Those terms generally apply to large-scale scientific machines designed primarily for scientists and engineers who deal with complex mathematically oriented problems. There are possibly as many as 40 such products being developed and even delivered today.

My definition is restricted to the breed commonly known as very large-scale general-purpose scientific computers and, more specifically, "today's most powerful general-purpose computer." That definition implies that there can be only one supercomputer at any one time, but we all know that any computer's power varies for different applications. So it may well be that today perhaps only two or three computers deserve to be called supercomputers.

In their day, the Eniac, the EDVAC, the ERA 1103, the CDC 6600, the CDC 7600, the Cray 1 and the CDC Cyber 205 could be legitimately called supercomputers. I believe the term first came into widespread use in the 1960s with the introduction of Control Data Corp.'s CDC 6600.

Each of these computers was designed and developed by small teams of highly capable technologists, usually in an environment of high risk. But none of them would have succeeded without the underpinning of advanced technology that resulted from years of federal government research and development funding nurtured in an environment of cooperation among the federal government, universities and industry.

In the '40s and early '50s, direct federal government funding of supercomputer development leaned heavily on the vast reservoir of electronic technology developed under government auspices during World War II.

In the late '50s and 60's, the pattern changed to government-supported base technology development. The government placed orders in advance of development by small companies, which risked their future on technical success with supercomputers.

Since the 1970s, the federal government's approach has been to buy its supercomputers at arm's length from established suppliers who take all the risk for their development. It is no coincidence that in the past decade, the rate of progress has slowed.

'Try before buy'

This "try before buy" policy, which is now common in U.S. government procurements, superficially seems equitable in protecting government interest, but it places too much of the risk for developing new supercomputer technology on the manufacturers, without any assurance of an adequate market.

In addition, since the market for supercomputers is relatively small, the major manufacturers are increasingly unable to justify the necessary investments to achieve the best performance in the time frame needed. This funding risk can be greatly alleviated if the U.S. government would commit to purchasing quantities of supercomputers in advance of their development.

Relevant history of government funding shows that the Aberdeen Proving Grounds funded John Brainard, J. Presper Eckert and John Mauchly to develop Eniac at the University of Pennsylvania. They started their own company in 1944 to design and market Univac, the first commercial electronic computer. Early on, the government contracted to buy three machines, but the onus was on Eckert and Mauchly to achieve specifications before payment was made — a significant change to the prior procurement pattern. In 1950, they sold out to Remington Rand, which subsequently merged with Sperry in 1955.

From then on, while Eckert and Mauchly continued to introduce improvements, their creative genius atrophied in the environment of a large company.

After World War II, I helped form Engineering Research Associates (ERA) in St. Paul, Minn., in order to retain a technical resource of vital national importance to the U.S. Navy. We had been developing special-purpose electronic systems for cryptologic applications. It was suggested that instead of forming our own company, we should attach ourselves to a public institution, such as a university or research foundation. However, we felt the need to better control our destiny by running our own company to avoid the lethargic and often unsupportive environment of a large institution.

ERA was formed in 1946, and in August 1947, it received a cost-plus-fixed-fee development contract for the design of a general-purpose stored computer, called Atlas, which was shipped in December 1950. I am convinced that if ERA had been part of a large organization, that development, if it could have been completed at all, would have taken several more years.

After ERA was acquired by Remington-Rand, the Atlas development spawned the ERA 1101 and 1103 computers, the first of the Univac 1100 series. In those days, government customers accepted responsibility for software development. They knew their problems far better than we, they had the resources and they made a tremendous contribution to the software art during that period and for many years after.

The National Security Agency (NSA) was a vital catalyst to supercomputer development in those days. A few of many computer firsts at NSA, all funded under cost-based contracts in the '40s and '50s, were the following:

- Demon, the first practical use of magnetic drums.
- Atlas I, the first parallel electronic computer with drum memory.
- Atlas II, delivered by ERA in October 1953, with vastly enhanced I/O capabilities compared with Atlas I.
- Lightning, high-speed circuitry research aimed at a 1,000-megacycle computer.
- Solo, the first completely transistorized computer.

It is clear that the '50s and '60s were a most fertile time for the advancement of supercomputers. The environment was characterized by enlightened self-interest and financial support from knowledgeable government agencies working with small entrepreneurial teams of computer engineers focused on the creation of

a single product. The work was underpinned by a vast reservoir of base technologies derived largely from government funding in the national labs, universities and major company basic and applied research organizations.

In the late '50s and '60s, assistance from the national laboratories was very important. The orders from Livermore for the first 6600 and CDC 7600 computers were of enormous help in leavening the risk for CDC.

The 6600 and 7600 developments followed the same pattern of success with a small development team. Seymour Cray's development group never exceeded 30 people, and of course, at the time of the 6600 development, CDC was still a small company.

In addition, the availability of risk capital for small companies since World War II — a unique feature of the U.S. economy — was vital to spawning the entrepreneurial enterprises that have done most to accelerate the state of the art in supercomputers. Eckert and Mauchly, ERA, CDC and Cray Research are salient examples.

Limited market

Although good growth is occurring, the market for supercomputers is still only capable of supporting a few competitors worldwide on its own merits. The market can be entered with the expectation of a reasonable return, but most companies opt for larger markets with lower risk and the potential for greater profitability.

Of course, a company can enter the market because of national or corporate prestige with the hope that the beneficial image it carries will provide better-than-average profits in other product and services lines of the company. History also shows that significant technological fallout occurs from supercomputer development to the benefit of less powerful computer products.

The supercomputer designer's never-ending struggle to balance computation and I/O capability has also been a constant spur to the evolution of peripheral devices.

Because of the high cost of supercomputers, the only reasonable way to provide access to them for the engineers, scientists and researchers who need to use them is by way of compatible, easy-to-use and reliable networks. This need, again, has been a constant spur to the evolution of network architectures.

Supercomputer developments have been a catalyst for enhancements of the technology in both system and applications software. Compilers such as Fortran and Pascal are being enhanced to exploit supercomputer hardware architectural features, such as vector processors, multiprocessors and parallel processors.

Preprocessor software is also appearing in the industry to help users gain greater benefits from their existing codes when they are run on supercomputers. New algorithms are being developed, and old algorithms are being researched and modified to optimize supercomputer applications performance.

In the area of reliability, today's supercomputer developments are advancing the state of the art in such areas as circuit maintenance, fault-tolerant logic, error detection and correction and remote technical assistance.

Nevertheless, the prestige and technology fallout motivations for a company to participate in the supercomputer market are propositions too tenuous on which to bet the national survival and international competitiveness of the U.S.

Direct support

Direct government support is necessary. It should take two forms. The first is funding for national labs and universities to buy and use supercomputers. This funding increases the size of the market so that more competitors can stay in the game. Second, it helps enormously in developing base technology within the national labs and universities and that technology can, in part, be the catalyst for new advances in supercomputers.

The funding available for national laboratories and universities to buy supercomputers declined seriously between 1970 and 1983. For example, during that time, CDC delivered 85 Cyber 7600 and Cyber 176 computer systems, not one of which was procured for a university in this country.

In contrast, we delivered seven 7600 systems to universities abroad. Two Cyber 205 systems were installed in U.S. universities by year-end 1983, while four were installed in European universities. And we wondered why the rest of the world was gaining on us so rapidly in basic research and advanced technology!

There were only three supercomputers installed in U.S. universities by the end of 1983 — at Colorado State, University of Minnesota and Purdue University. Each of them was underutilized, and other university researchers were unable to take advantage of their research benefits because of lack of funds.

Fortunately, the U.S. government has finally recognized its need to help assure the continued leadership of the U.S. in supercomputing. The National Science Foundation decision, prompted by the Lax Report to resume its policy of providing grants for supercomputing support at U.S. universities, is beginning to prove very beneficial.

The second needed form of support is for the government to assume more of the funding risk for supercomputer development and the advanced technology on which it relies, particularly in the area of component research. Industrial co-

operative enterprises, such as the Microelectronics and Computer Technology Corp. and Semiconductor Research Corp., can bear some of that advanced technology burden but not enough of it.

Another lesson from history is that product development is best done by small engineering teams working in an environment uncluttered by bureaucracy. In the U.S., at least, the small company is undoubtedly the most conducive environment for such development. It is entrepreneurial. It is dedicated. Its personnel have fortunes to gain from success and bankruptcy to face from failure. There is no better motivation for hard and creative work. The small company lacks deep pockets and is therefore forced to focus on the most direct route to success.

Government agencies and national laboratories that place advanced orders can look forward to a far closer working relationship with a small company than is possible with a large corporation. That relationship can be the stimulus for more beneficial cooperation between the parties if for no other reason than that the CEO is inevitably more accessible — and if the small company gets out of line, the government's kick will be felt far more in a small company than in a big one.

The government is also less vulnerable to the accusation of providing unfair competitive advantage to the small company than would be the case if the same contract were awarded to an established competitor.

Direct government R&D funding of commercial supercomputers beyond basic advanced technology should be concentrated in the area of applications. Learning to fully use the power of new architectures is a painfully slow process. But it could be much faster if there were more directly sponsored government work in universities and laboratories as a means of better applying these machines to important classes of problems.

By the end of this century, the architectural improvements over the next one or two decades may be implementable in optics rather than electronics.

The trend in supercomputers is undoubtedly toward more parallelism. The massively parallel supercomputers of the future will provide enough simulation speed and accuracy to provide a profound analytical resource to help us deal effectively with the complexities of our world. No longer will it be necessary, in most cases, to rely on approximate solutions based on costly empirical experiments or analog analyses.

Examples abound in education, in three-dimensional imaging, medicine, chemistry, genetics, fluid dynamics, destructive testing and weather modeling and forecasting, as well as a wide range of applications in the economic and social sciences. Significant results are being achieved today, but there are far more opportunities waiting to be explored.

The trend toward greater parallelism will permit truly scalable computing to be realized for the first time, with the resultant evolution of more powerful minicomputers that are truly compatible with their supercomputer brethren.

By the end of this century, the architectural improvements over the next one or two decades may be implementable in optics rather than electronics. Optical computers capable of operating hundreds of times faster than their electronic counterparts may well be realized. When this happens, the devices on which these optical computers are based will open a wide spectrum of novel approaches to computer architectural design.

The heart of computer networks

Inexpensive communications, based on fiber-optic technology, will be at the heart of highly reliable new computer networks that are completely transparent to computers of different origins.

Application software, created with the assistance of artificially intelligent computers, will be more precise, more adaptable, more reliable and dramatically less expensive to develop than ever before.

And the interaction between the human and the computer will become profoundly simpler and more integrated as future machines learn, increasingly, to become articulate in human languages. But above all, progress in artificial intelligence will be the key to the full integration of the computer with its human partners.

Already, by concentrating on knowledge representation — the machine counterpart to human memory — researchers are delivering practical results, especially in the field of expert systems. Although machine intelligence, as Alan Turing defined it, has not yet been achieved, limited but commercially viable expert systems are beginning to emerge.

Relatively little has been achieved so far in machine vision — not because there has been little research, but because the obstacles are immense. While assembly-line robots now have some ability to discern shapes, the problem of eliciting keen discrimination from machines is proving very difficult. Machine reasoning and natural language processing remain largely the subject of the laboratory, not commerce. But because natural language can be used in applications where vocabulary needs are limited, natural front-ends are beginning to find their way into a few application areas.

In my opinion, AI will eventually become so architecturally embedded in systems and products that it will cease tc exist as a separately identifiable entity, just as the microprocessor is invisible in many domestic appliances today. It is probable that expert systems that truly rival the capabilities of the human expert in a wide variety of fields will be available in the mid-1990s.

Expert systems will become prevalent in application areas where knowledge bottlenecks are present, where job performance is inconsistent, where a process must be performed more rapidly than is currently possible, where adverse working conditions and tedious or repetitive tasks make human involvement unpleasant, where rapid change is being experienced and where knowledge-intensive tasks are key.

Take the matter of education in our public schools. By any measure, the public schools in the U.S. are failing badly at their most important tasks. A good deal of attention has been paid to scores on the Scholastic Aptitude Tests in recent years and on the failure of many students to deal with even the simplest writing and reading tests.

As the schools face this crisis with increasing enrollment, declining numbers of teachers and the persistent problems of motivating a group of students with widely diverse learning backgrounds, they need help.

Fortunately, the development of computer-based education systems has already reached the point where computer-assisted instruction can provide high-quality educational experiences for all youngsters.

Similarly, the instruction management and student testing components of these systems, which include embryonic expert systems characteristics in some cases, have reached a level of sophistication well beyond anything imagined just a few years ago.

As a result, teachers can be far more effective than before because they have the capability to analyze, diagnose and prescribe for each individual student's particular learning needs, assisted by the computer-based education system.

In summary, supercomputers will continue to be critically important in helping to maintain the nation's well-being and catalyze major advances in computer technology. Progress in artifical intelligence will be the key to the full integration of the computer with its human partners, and expert systems in a wide variety of fields will be available in the mid-'90s.

There are exciting days ahead in the design and application of computers.

HANDS-ON

Surgical robot performs biopsies

Ole has performed 18 biopsies of brain tumors, and he's less than 3 years old. Eventually, when he has gained a little more sophistication and learned to interact better with strangers, his inventor expects even greater things of the surgical robot.

Inventor and electrical engineer Yik San Kwoh directs CAT scan research at Memorial Medical Center in Long Beach, Calif. "I don't really know the end potential, but I think we've just barely scratched the surface," Kwoh says. "There are any number of situations that demand the kind of precision and stability that a robot like this offers." The hospital is planning to expand Ole's sphere of responsibility to include assists in brain stimulations, Kwoh says. A few other possibilities include eye surgery, spinal surgery and knee joint replacements.

Kwoh wrote Ole's software, which works in conjunction with a CAT scanner, during a period of three years in consultation with eight other researchers. Ole was named after a benefactor of the hospital, Sven Olsen, who underwrote the robot's purchase and much of the development expense.

The robot wields its 29-lb., six-jointed aluminum hand with accuracy that even a brain surgeon could envy. In fact, Kwoh says, the robot is so exact that it has reduced the necessary size of a biopsy incision from one-half or five-eighths of an inch down to one-eighth of an inch.

Other advantages the robot brings to this kind of work include memory precision, mobility and relative immunity. Ole is able to return to the same spot with an accuracy within two thousandths of an inch, can be moved easily from one location to another and does not suffer ill effects from X-ray exposure.

That last characteristic could be particularly valuable in reducing time spent in operations where surgeons could benefit from having continuous CAT scan readings. According to Kwoh, Ole might someday be used to perform actual surgical procedures while the human surgeons direct its hand from another room, outside the X-ray's reach.

COMMENT

Americans do great things when they can stand on a foundation of technology as they respond to perceptive leadership. Our response to the Soviet challenge in space and President John F. Kennedy's stated goal of landing men on the moon and returning safely to Earth stood principally on a growing understanding of how to process and use information rapidly and accurately.

Although primitive in comparison with the computer of today, the *Apollo* flight, launch and mission control computers made possible this first great adventure by humankind in space.

The next great adventure in space, the human settlement of Mars, will depend even more heavily on computer technology. The largest remaining question is whether it will be Soviets or Americans who lead in the application of computers to this pivotal project of the third millennium.

HARRISON SCHMITT
Apollo astronaut and former U.S. Senator

Technology changes, but human nature stays the same

We can channel technology to our own needs, but we may be at the mercy of our own nature

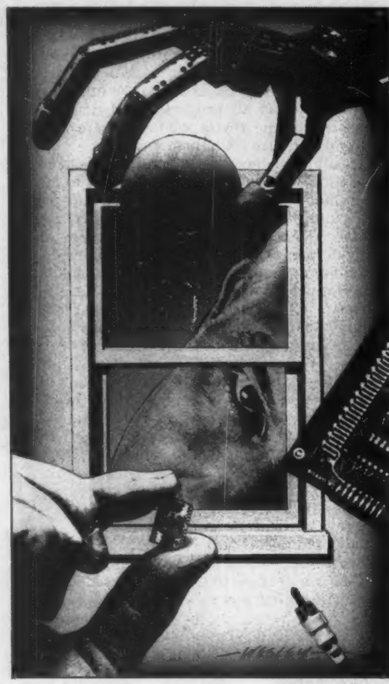


ILLUSTRATION BY CARL WESLEY

BY JAMES MARTIN

As we look at the next 40 years, there is one thing we can be reasonably sure about: Human nature will not change.

Playwright William Shakespeare described with great skill human nature as we observe it today. We have the same power struggles — greed, love, kindness, jealousy, treachery — as in Shakespeare's day. It is a reasonable bet that it will be the same 40 years from now.

This same human nature will be set against a background of astonishingly different technology. Explore in your mind the different possibilities, and ask yourself, Given this technology and human nature, how can we build a better world?

We are involved in a technological revolution of potentially greater impact than the industrial revolution. But unlike the industrial revolution, it is happening with devastating speed. It will leave no business, no industry, no institution untouched.

Consider the potential technological applications, which include microelectronics, genetics engineering, chips doubling in density every year, worldwide networks linking millions of computers, robotics, mass-production factories operating largely without workers, nuclear fusion, "Star Wars" defense systems, optical fibers that can transmit the whole of Shakespeare's works in a quarter of a second and computers for artificial intelligence applications running 10,000 times faster than today.

This technology has shattering long-term potential. New societal patterns are being forged in the crucible of high technology. Technology is changing exponentially, not linearly.

Sometimes it seems technology is moving so fast that it is out of control. Soon it will be moving much faster. The era of artificial intelligence has barely begun. Computers are being used to design ever-better computers. The explosive growth in computer power speeds up the development of genetics engineering, robotics, weapons systems and all other technologies. How can the institutions of today's society — government, the workplace, schools, the family — stand the strain of change?

Few people are thinking about the future impact of technology. Ours is an age without pragmatic philosophers. Most people who write about the social impact of technology write about past or present technology. A new subject is needed in universities: the philosophy of technology. This subject, so vital to our future, is currently addressed only by a few negative diatribes against technology.

We must always recognize that we're not at the mercy of technology. We can channel it to our own needs. However, we may be at the mercy of our own human nature.

But what is the purpose of it all? To build a more civilized world? Utopia? A golden age? There are a few brief periods in human society that might be described as a golden age. What kind of golden age could we achieve if the world population is eight billion and machines are ultra-intelligent? And what would endanger it?

If Western society would make the right decisions during the next 20 years and the public understood the issues, there would be excellent prospects for a golden age of civilization such as the world has not yet seen — and within the lifetimes of most of us. Young people especially must be determined to make it happen to achieve a brighter future.

In discussing civilization, it is extremely important to distinguish between ends and means. Most people are preoccupied with means. Technology, law, management, politics, programming, corporations, the civil service and making money are all means, not ends in themselves.

Ends relate to how we enjoy the fruits of such labor or money making. When we lose the perspective to concentrate on ends, the means take over. We perform work for its own sake and create more work. Civil servants multiply their bureaucracy, destroying not only their own pleasure, but other people's pleasure also. The legal system perpetuates ever more Byz-

HANDS-ON

Computerized shoes track training

Dan Westin, a sales representative for Ericcson Network Systems in Oakbrook, Ill., estimates that he has increased his average running distance by at least 40% since he bought himself a new pair of running shoes last June. "There's no doubt they have been getting me out on the road a lot more," he says.

If it sounds like Westin is attributing extraordinary powers to his footwear, there is good reason. For his workouts these days, he wears the RS-Computer running shoe from Puma USA, Inc. of Framingham, Mass. The shoe is a jogger's accessory designed as a computer peripheral.

When Westin wants to know how far and fast he has run or how many calories he has expended, he unlaces his shoes and plugs them into his Ericcson PC 1 personal computer, using a 3-foot cable and software provided by Puma. A sensing device and board circuitry, built into the heel of the shoe and calibrated to his own particular stride, capture and record that data as he runs. Once the data has been downloaded into the computer, Westin can look at the information in comparison with past performances or desired performance.

In Westin's case, the motivation comes from being able to compare his distances against a daily training record. Wearing the shoes has also given him more freedom in his choice of running routes, he reports. Since the shoes can also be programmed from the computer with instructions about desired mileage, Weston doesn't have to worry about confining himself to measured tracks. "If I want," he says, "I can take a new route every day."

According to Fritz Bredenbeck, product marketing manager for the RS-Computer shoe at Puma, computer-equipped amateur athletes like Westin seem to be accounting for most sales of the shoes thus far. "This product could certainly be useful for the experienced runner," he says, "but I think it actually leans more toward a person who already has a computer and wants to run but maybe just needs some incentive."

The shoes and software, designed to run with micros from Apple Computer, Inc. Commodore Business Machines, Inc. or IBM (including compatibles), come with a 45-page user's manual and sell for $200.

Westin has no doubt about the value of the shoes. The only negative, he says, is that they may do the job of motivation a little too well. "They made me so enthusiastic that I overdid it a bit at the beginning and wound up putting myself out of commission for several weeks."

COMMENT

My world is the field of sports. Computers have radically changed our operating modes and methods of analysis as well as called into question some hitherto unquestioned assumptions about instruction.

In addition to word processing, computers are used to analyze tennis matches for coaches and television commentators. At AMF-Head, we just introduced our first CAP (computer-aided program) rackets, and our testing models have been refined as a result of computer analysis.

I have an IBM PC XT and a Compaq Portable. Computers now are indispensable.

ARTHUR ASHE JR.
Wimbledon champion, 1975

antine and destructive machinations.

A highly civilized society concentrates on the ultimate purpose of its labor and minimizes the drudgery needed to achieve the purpose. It refines as fully as it can the pleasures that civilization can achieve.

Technology has an immensely important role to play in achieving this objective. It can remove drudgery. It can create wealth. It gives us superb stereo systems and wall screens. It gives us mobility. It gives us the machinery of filmmaking and theater.

However, like the other means, technology tends to take on a life of its own, unrelated to the goal of being civilized. When it becomes an end in itself, technology is pointless. We need to regard technology as a tool to achieving a greater goal.

New technologies destined to dramatically change society have always taken us by surprise. There has always been a reluctance to anticipate or believe the implications of powerful technology. The industrial revolution caused such a fundamental change in history that

When it becomes an end in itself, technology is pointless. We need to regard technology as a tool to achieving a greater goal.

it could not have been anticipated. By the 20th century, the early warnings of new technology should have been heeded.

It took two centuries to build Saint Peter's Cathedral in Rome. In the 20th century, we have lost the vision to manage projects of long duration. We need once again to have grand visions, projects that span multiple lifetimes.

Civilization should mean the striving for excellence, but more than just excellence in literature, arts and sensual satisfaction. We need great projects, goals that enormously expand the capability of man. We have had intelligent machines for a time span that amounts to nothing in evolutionary terms. We need visions of how we should evolve.

The technical advances of the next 40 years will be much greater than those of the last 40. Our ability to recode genes will improve with genetic engineering processes being controlled by computers. Computers themselves will use biological circuits. Our unlocking of subatomic particles will be a billion times more interesting than the splitting of the atom, and probably more dangerous.

Mankind's greatest engineering accomplishments will be in space. We will soon have a long-chain-molecule fiber so fine and strong that many thousands of miles of it can be coiled up on a large drum, taken to geosynchronous orbit, attached to a space vehicle and strung across space. It will become more possible to shift everything that is dirty and dangerous to space and concentrate on making the earth into a beautiful place.

An imperative for society today is that human potential must be developed as quickly as technological potential. In many cases, we are failing to do that. We must strive for a greatness in everything, but above all for greatness in extending the frontiers of mankind.

Martin is an internationally recognized author and lecturer on computer technology. His software company, Knowledgeware, Inc. in Ann Arbor, Mich., is building software tools to implement his information engineering approach to DP systems building. This material is a preview of his new book, Technology's Crucible, *available this fall from Prentice-Hall, Inc.*

COMMENT

Like ancient Egyptian temples and pyramids, the early computers were the brainchildren of a few very sophisticated designers. Overseeing many hundreds of workers, these early engineers created something awe inspiring in scope and mystifying in concept — to just about everyone except for the designers and the priests.

Where the ancients built their giant temples to safeguard their deities, we built huge climate-controlled facilities to safely ensconce our early computers far away from the ordinary folk. And where the ancients had a society of priests to minister to their gods and act as intermediaries with the people, we had large staffs of engineers and programmers to fill a similar role.

Of course, the analogy isn't perfect. Egyptian culture developed during several thousand years. Computers have evolved in decades.

Computers have become powerful everyday tools holding few mysteries for even the most unsophisticated user. And it all occurred in the time it takes an infant to mature into a productive adult.

AUGUST KLEIN
President, Masscomp Co.

Supercomputers on the way to the CIA

BY WILLIAM CASEY
Director, Central Intelligence Agency

Computers have played an important part in the Central Intelligence Agency's activities since the early 1960s, when the first mainframe units were installed. At first, these computers were used primarily for administrative tasks such as payroll and inventory, but it was obvious from the outset that computer technology could assist the agency in its principal activity — collecting and processing intelligence information.

The computer has become an essential tool in our business. The vast amount of information pouring into the agency must be quickly distributed, stored and retrieved by numerous individuals. That information must then be analyzed, often with the support of computer-based methodologies.

Frequently, this analysis deals with crisis situations and must be completed within a very short time. Most important, the results of this analysis must be delivered quickly to the responsible policymakers to help them understand the implications of their policy initiatives and the response to those initiatives.

Computing power at fingertips

With the computer support now available, CIA officers have substantial computing power at their fingertips. For example:

- Thousands of cabled messages are automatically screened every hour and routed to the appropriate officers. The recipients read, annotate, route, save and retrieve these messages in a totally electronic environment.
- A large-scale office automation and electronic mail system permits nearly instantaneous communications among agency personnel.
- Intelligence officers use special CIA-designed software to manage the agency's technical and human collection programs and to process the output of these programs.
- Military affairs analysts and scientists use large mainframe computers to conduct sophisticated simulations of modern weapons systems.
- Economists work with advanced models to forecast the economic performance of key nations.
- Political analysts rely on data management systems to analyze patterns in terrorist activities, narcotics trafficking and the political stability of selected countries.
- Cartographers and publication specialists have access to the latest computer systems for designing and producing maps and charts, as well as specialized graphics.

More important role

In the coming years, computers are likely to play an even more important role in the CIA, enabling intelligence officers to improve both the quality and efficiency of their work. Soon, every officer will have a multifunctional high-end workstation at his or her desk.

In the near future, CIA scientists will be able to call upon the power of supercomputers to conduct highly complex scientific analyses. The CIA is also exploring the applicability of artificial intelligence, optical-disk storage technology, robotics and other advanced techniques.

We are excited about the future of computer technology and the unique contribution it makes to national security and the intelligence profession. Our thanks go out to the talented and dedicated computer professionals who have made these marvelous advances possible.

"Humanity has developed a great many badly conditioned reflexes. One is the idea that technology is something new. [We've come to] think of technology only where we began to be the inventors — as machinery of war or to exploit humanity. I find this antitechnology ignorance very greatly troubling. I say our whole escape is through technology."

R. BUCKMINSTER FULLER, 1981


USER
CONTROL
IBM CONN


Meridian* business services offer more than Centrex.
Today, you can choose from a whole supermarket of data services through the public telephone network. Act now and be ready for a future where sharing data, text and image will be as easy as using the phone.
nt northern telecom
COAX ELIMINATION
DATA ABOVE VOICE
meridian
NETWORKING

Computers and man fly high together

BY MARC GARNEAU
National Research Council of Canada

Without computers, there would be no space flight and no astronauts beyond the imaginings of science fiction. Spacecraft rely extensively and increasingly on the computer's speed and accuracy in the hostile environment of space.

The relationship between computer technology and space flight has been synergistic. The need for computers to drive space exploration has itself contributed to the development of computer technology. Squeezing computer equipment to fit the odd corners and restricted areas of spacecraft such as the Apollo, Voyager and shuttle vehicles propelled microchip technology. At the same time, the use of computers in the glamorous field of space exploration certainly sped the popularization and widespread use of computer technology in other fields.

For example, during my flight on Mission 41-G in October 1984, my role as a payload specialist included a scientific experiment with a Canadian instrument known as a Sunphotometer. It was designed essentially to measure the intensity of sunlight reaching the surface of our planet.

What was ironic was one piece of equipment I used to conduct this scientific experiment. It was a small laptop computer — a brand-name, off-the-shelf consumer device that might be used by high school students for homework assignments. Yet, here it was, ready to be launched into space. What it represented was, in fact, an indication of the speed with which we have forged into the era of the computer, integrating the computer into so many aspects of our lives.

A decade earlier, the laptop would have been a marvel in its own right. Yet, as I prepared for this space mission, surrounded by multimillion-dollar equipment and sophistication at every turn, it was ironic to be conducting serious science with equipment that has become, literally, child's play.

The tiny laptop prompted me on procedures with the Sunphotometer, digitized the data and stored it on an audio cassette for later analysis on Earth. Unlike a ballpoint pen or a soft drink can, the tiny computer required no special modifications for its space mission.

That experience is obviously not typical of the degree of sophistication of computers in the space program. But it did point up the popularization of computer technology and the extent to which we rely upon and accept it.

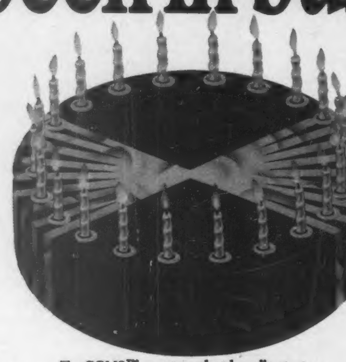
Vision system

My mission also involved a more sophisticated application of computer technology, one which will have a significant impact on terrestrial industries. The experiment involved testing of a Space Vision System (SVS) developed by Canada's National Research Council, initially for use with the Canadarm remote manipulator system on board the shuttle.

Human vision is severely limited under the extreme lighting conditions of space, to the point where it is difficult to judge distances accurately or collect other information normally available to the naked eye on Earth. Using targets affixed to objects in the vicinity of the shuttle, SVS single-camera hardware gathers the data. Then SVS algorithms calculate the distance, attitude, velocity and spin of the object, such as a satellite entering or leaving the shuttle's payload bay.

Terrestrial applications have already begun, the first of which involves Canadian industrial robots used in manufacturing automobiles. Ten years hence, we will probably take as a given the services of a robotic Step-'n'-Fetch-It serving up specific components for complex manufacturing tasks.

It's no surprise that as we continue to expand the human presence in space, we will be guided and protected by increasingly more sophisticated generations of computer technology.



In "AI-1 Symbolic Homage to Picasso," artist Lillian Schwartz embodies David Maher's concept of "a language of shapes." The original art was in color.

A portrait of the artist

BY ARNO PENZIAS

The artistic use of various forms of analog computing goes back to the early days of the 20th century. No single event can be identified as marking its beginning. Fortunately, the situation is much clearer in the case of modern digital computers.

What we now know as computer art began in December 1968, when Lillian Schwartz grasped a light pen and began to draw.

She began with a digitized image of a group portrait of her three Bell Laboratories collaborators, Leon Harmon, Ken Knowlton and John Vallaro. She was able to enhance this image by creating and using a set of symbolic picture elements that added brightness levels and texture, as well as additional surprises on closer inspection. This effort constituted the first full-scale example of digital picture processing in our industry, not to mention in the art world. Within a year, she had also initiated the first realization of computer-generated color images, and the field was on its way.

Those who worked with her in those days still remember her monumental ingratitude to technology. As each problem was solved and each new capability came into hand, a new round of probing explorations would begin and off she would be, asking for the impossible all over again.

In 1976 she used computer-controlled video images to create "On-Line," a punchy portrayal of a rock group's music, blended with the sound and movement of a dancing vocalist. It was different enough from anything that she, or anyone else, had done to be in a category by itself, to which she attached a simple but enduring name. In the list of Lillian Schwartz's films for 1976, one can find the laconic description: "On-Line, 10-min. rock video."

Over the years, her film and video work has won a number of awards. The special effects she did for "Lathe of Heaven" earned the film an Oscar in 1980. In 1985, her computer-generated commercial for the opening of the rebuilt Museum of Modern Art won an Emmy. Its visual impact was heightened by another of her inventions, a carefully tuned interleaving of images at scene changes that make use of the pre- and postattentive properties of human vision.

The MOMA commercial was part of a project she undertook at the Thomas J. Watson Research Laboratories with IBM's Richard Voss. She was commissioned by the museum to create a computer-generated poster for its new opening. Once the project was in hand, the presence of a much earlier computer graphic in the museum's collection was "discovered," a 1972 "silkscreen" by Lillian Schwartz. At the time of the silkscreen acquisition, computer art wasn't an acceptable category.

Some years ago, the late David Maher had suggested that a list-like set of connections could be constructed for the components of visual images, leading to a language of shapes. Lillian Schwartz's "AI-1 Symbolic Homage to Picasso," pictured here as a black-and-white rendition, is the first result of her successful realization of Maher's insight. The flowing form of the picture makes it totally unrecognizable as computer art. It looks as if it had been painted without computational intervention. This same environment was used to create the landscape featured on the cover of this issue.

As Schwartz puts it, "Where AI created meaningful verbal descriptions of knowledge, I have taken the same environment and made meaningful connections between the concepts that underlie graphic objects. I'm insulating myself by being able to work in a higher level environment. I am free to create instead of keeping track of where I am. I can now work simultaneously with two- or three-dimensional environments, geometric or free-flowing shapes, creating and changing palettes more easily than opening and closing tubes of paints. I now control the computer — the computer does not control me or direct me."

What is Lillian Schwartz doing for an encore? She's using the computer as an analytic tool, "taking apart" great paintings to study their structure, composition and handling of colors. The works of Matisse and Picasso were among the first to be studied in this way. She recently added Leonardo da Vinci to her list, with remarkable results. She has come up with an unusual, but surprisingly persuasive answer to the riddle of who served as the model of the Mona Lisa. She is expected to reveal her findings shortly.

Penzias, vice-president of research at AT&T Bell Laboratories, is the author of a forthcoming book on the societal impact of computers. In 1978, he was awarded the Nobel Prize in physics.

An extension of man's mind and brain

BY ROD CANION
President, Compaq Computer Corp.

Like many others both inside and outside of the computer industry, my life has certainly been touched by the forces set in motion when Eniac was developed at the University of Pennsylvania some 40 years ago.

And I suppose it wouldn't surprise anyone to hear that of all the developments during the past 40 years, I personally have been most affected by the evolution of the personal computer.

I, like many others, believe that the PC is a very powerful instrument in history — more than a tool, because it is an extension of the mind and brain that organizes and analyzes vital information and literally expands our capacity for creative thought and activity.

This understanding came to me relatively late compared with a lot of people in our industry, I'm sure. I would probably still be at Texas Instruments, Inc. or running a Mexican restaurant if I hadn't walked into a Radio Shack store one day in 1981 to kill some time and asked to see this Visicorp Visicalc I had heard so much about.

A young clerk gave me a short demonstration, and I was immediately overwhelmed by its power and potential. More than just saving considerable time in many aspects of one's work, it could truly make one more creative and productive in very subtle ways.

When Bill Murto, Jim Harris and I decided to develop and build the original Compaq Corp. Portable Computer, the emerging PC standard was not yet apparent. The IBM Personal Computer was selling well, and we saw the market opportunity for a portable product that was strictly compatible. But neither we nor the rest of the infant PC industry had yet perceived the quiet movement of market forces which were converging to form the PC standard.

Much of the foundation for the standard had already been laid. IBM had chosen to build the PC around the Intel Corp. 8088 microprocessor and IBM's PC-DOS, a variation of Microsoft Corp.'s MS-DOS.

IBM followed these key decisions with two others that proved to be important building blocks in the evolution of the PC standard. The PC's architecture was opened up to hardware and software developers, and IBM chose to sell it through separate authorized dealers instead of its own sales force.

Out of all these factors, I'm convinced that the decision to design the PC around the Intel 8088 was key. The 8088 broke the dam of developers' pent-up creativity and innovation, which had been building due to the inherent limitations of the Zilog Z80 processor and CP/M. The resulting focus on the PC by the personal computer software industry was the final building block in creating the PC standard. That, of course, and the fact that IBM sold lots and lots of PCs.

The key factor for Compaq was a decision we made early in the planning process for the portable in distinguishing between MS-DOS compatibility and compatibility with the IBM PC. We decided that the Compaq portable had to have a level of compatibility that would allow it to run any of the software being written for the PC. I'm certain that if we had done otherwise, it would have been charting a drastically different course for Compaq.

The uniqueness of the standard is a philosophical issue for me. What I mean by uniqueness is that in almost every other area, there have been dislocations as the field advanced, or it advanced so slowly no one noticed. Each time, past skills and knowledge had to be abandoned and new ones learned.

In contrast, the personal computer standard means that for the first time, a capability can be built upon, advanced and improved without giving up the use of skills, experience and knowledge that were gained before.

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HANDS-ON

Electronic tethers: An alternative to the Big House

The idea came out of the funny papers, but electronic manacling as an alternative to incarceration of certain types of offenders has now become a serious tool for the criminal justice system.

Jack L. Love, now a private-practice attorney in Albuquerque, N.M., was serving as a district court judge in 1979 when he spotted something in his favorite comic strip that seemed like a possible solution to prison violence. Spiderman was captured by an arch-villain and forced to wear an ankle bracelet that transmitted constant radio signals and allowed his enemy to track his every move. When Love read that strip, he says, something clicked.

Love had been concerned for some time about the physical dangers facing both guards and prisoners in penal institutions. He was sure that a similar device could be created for use in prisons and sent a letter off to the state Department of Corrections suggesting that they investigate the possibility. What he got back, he says, was a polite letter of dismissal.

The whole matter might have ended right there if Love's worst fears had not been realized several months later when the New Mexico State Penitentiary at Santa Fe exploded in an orgy of violence that left 30 inmates dead and a number of guards brutalized. It was that nightmarish event, Love says, plus a mounting problem of overcrowding in Albuquerque jails, that kept the idea alive in his head for two years and finally pushed him to approach Honeywell, Inc. about developing an electronic ankle bracelet that could be used as an alternative to conventional custody.

Honeywell wasn't interested either, according to Love, but one of its employees was. In fact, Mike Goss, a sales representative, was so intrigued by the concept that he left his job and poured all his savings into starting a company to research, develop and market such a device.

Now, not quite four years later, Love's idea has spawned not just one viable product, but five or six. All told, there are probably 200 or so offenders across the country now wearing some version of tracking bracelet to enforce sentences of house arrest, Goss says. He now works for B. I., Inc. of Boulder, Colo., which purchased his company and completed development on the bracelet and monitoring system.

Home Escort, the system that B. I. is marketing, has been installed by law enforcement agencies in five states as an alternative to incarceration for some first-time offenders, traffic offenders, juveniles, parole violators and prisoners who have served most of their terms but are not yet eligible for full probation.

Use of the technology within prisons themselves, which was what Love initially envisioned, has not proven technically feasible for a couple of reasons. To begin with, Goss says, the steel bars and reinforcements within prisons would interfere with the radio signals the bracelet sends to the microprocessor-based receiving unit.

The circuitry built into the bracelet makes it virtually tamperproof, and the complex algorithms governing the timing of status queries fron the NCR Corp. Tower mini that is the central monitoring unit to the phone-linked field receiver make escape unlikely. However, Goss says, neither Home Escort nor any other system is yet as failproof as the prison environment would require.

Nevertheless, by using a system that essentially amounts to a 150-foot electronic tether, Goss says, it is possible to achieve at least part of what Love had in mind. "What we are doing, essentially, is both protecting society from the nonviolent felon and protecting that felon from the threat of violence in prison."

If the technology becomes as widely accepted as Goss thinks it will and if, within five years, 40% to 50% of the current prison population has been shifted out of the institutions and placed instead in home incarceration with electronic monitoring, "we may be able to break the cycle of recidivism and escalating violence," Goss says.

Love was given the opportunity to field-test Home Escort in its early prototype stages. He was pleased with the system's performance in the four instances he used it — three cases of technical parole violations and one second-offense of driving while intoxicated.

"I think it's a viable tool," he says. "It isn't necessarily suitable in all instances, but it does give judges another alternative in sentencing."

And obviously, he adds, some new alternatives are badly needed when prisons are producing violence on the level of the Santa Fe riot and overcrowding has reached a stage where, as was the case in Albuquerque, offenders have to wait 100 days for a place in a work-release facility.

"DOMIN *(General Manager of Rossum's Universal Robots):Robots are not people. Mechanically they are more perfect than we are, they have an enormously developed intelligence, but they have no soul.*

HELENA: How do you know they've no soul?

DOMIN: Have you ever seen what a robot looks like inside?

HELENA: No.

DOMIN: Very neat, very simple. Really a beautiful piece of work. Not much in it, but everything in flawless order. The product of an engineer is technically at a higher pitch of perfection than a product of nature.

HELENA: But man is supposed to be the product of God.

DOMIN: All the worse, God hasn't the least notion of modern engineering."

KAREL CAPEK, 1921
from *R.U.R.*

Universal programming

BY BOB FRANKSTON

The dramatic changes in computers are only a prelude to the future. I contend that this future is not one in which computers are smart enough so that people no longer have to bother with programming the machines, but rather one in which programming is, itself, a common activity.

We each have our own ways of looking at the last 20 years of the computer industry. My personal one is the comparison between the core box on the IBM 7094 (32K, 36-bit words) and the 1M chip. They are about the same capacity. One was a major expense, the other an inexpensive commodity. There are many other dramatic changes in the hardware available. Even to people in the industry, it takes a while to realize that at $100 per megabyte, a 60M-byte drive with 30-msec seek time is about $1,000. Or you can go into your local department store and buy a complete system, including a hard disk, for less than $800.

But what does all this casually available computation mean? Some of it shows up in the expected places. We are used to watches that tell time and keep a year's appointments as well as perform calculations. The engines in cars are constantly monitored by dedicated computers, and banking is done via automated teller machines.

And then there are electronic spreadsheets. Having co-developed Visicalc in the late 1970s, I have given much thought to why this type of software has had such an impact. My favorite analogy is with the telephone dial. It gave people much of the same capabilities the phone operator has. A person can place telephone calls by keying in a sequence of digits; the phone system takes care of the rest.

In my view, the essence of the electronic spreadsheet is that it makes the power of the computer accessible to a large number of people. The key word is accessible. While price is an important issue, the computer as a tool is not accessible unless one is able to exercise sufficient control. Since the language of the electronic spreadsheet is congruent with people's own models of computation, they are able to use it to manipulate the system directly.

The concept of programming is not, in itself, new. The idea of presenting a series of instructions or rules predates computers. What is new with computers is the understanding of how to describe very complicated processes.

The use of higher level languages such as Fortran and Cobol was originally referred to as automatic programming. And it is, relative to the use of machine language. The concept of very high-level languages in the guise of report generators, electronic spreadsheet and data base management systems continues this trend of making programming directly accessible to users.

But there still aren't enough programmers to do all that needs to or can be done with computers. As with the telephone, the answer is to make programming generally accessible. While high-level languages are important to this trend, there is still an intrinsic core of ideas that represents programming.

Joys of programming

People are surprisingly willing to program. One of the keys to the success of Lotus's 1-2-3 is the willingness of a large number of people to program in its macro language, going beyond the simple programming present in the spreadsheet itself. Perhaps more dramatic is the popularity of Borland International Inc.'s Turbo-Pascal, which has sold thousands of copies, much to the surprise of its creator.

Languages such as Basic and Logo are being taught in school. They are not necessarily being taught well and they are not necessarily the ideal languages, but there is an increasing understanding of what programming is.

The next step is to apply these concepts more universally. I expect to be able to program my word processor to meet my needs and to write documents in a document language that allows me to control the presentation beyond the placement of words.

One of the tenets of Logo is that teaching these concepts has an impact beyond computers in how people conceptualize processes.

Computers are platforms for expressing these concepts. But it takes time to learn the means of expression and how to improve the platforms.

A spreadsheet is a static description of data. An electronic spreadsheet breathes life into this description.

Frankston, Chief Scientist of Lotus Development Corp.'s Information Services Division, was coinventor of Visicalc, the first electronic spreadsheet.

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	San Francisco	Aug 5, Sep 9, Oct 14, Nov 6, Dec 9
	San Jose	Aug 7, Sep 23, Oct 21, Nov 13
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	New York City	Jul 24, Aug 12, Aug 26, Sep 3, Sep 17, Oct 2, Oct 22, Nov 6, Nov 25, Dec 9
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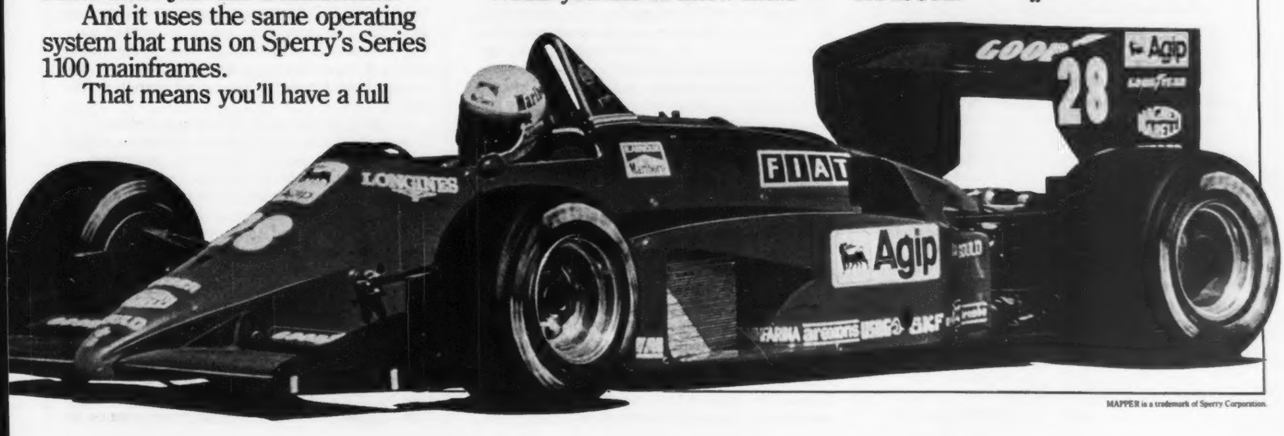

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COMPUTERS AND BUSINESS

'Informational Man' struggles to control information society

BY AUGUST BEQUAI

The computer revolution encompasses a plethora of technologies — robotics, communications networks, electronic banking, software, computer electronics and other technologies at the cutting edge of modern scientific developments. Fueled by human intellect and manned by an army of technicians, engineers and scientists, the computer age has given rise to the informational man.

The computer's impact on society cannot be measured solely in terms of the number of men and women connected with its production. While more than 20 million Americans are connected with manufacturing, fewer than six million have any peripheral contact with the computer industry. As for the 25 million jobs that will be needed by 1995, the computer industry will supply fewer than 10%. Numbers are poor indicators of the impact this industry has had and continues to have on our social and economic institutions.

Few will dispute that the computer revolution has become the dominant driving force in the postindustrial society. Its long-term impact could turn out to be at least as important as that of the Industrial Revolution. For no modern government or business could long survive without the assistance of computer technology.

But computer technology has also made the postindustrial society more vulnerable to the fears of Aldous Huxley's "brave new world" — abuses of privacy, electronic eavesdropping, new types of crime, computer warfare and terrorism, and other dangers. We would do well to "revisit" this brave new world in the context of the computer revolution.

In Washington, D.C., more than 4,000 welfare recipients were dropped from the city's welfare rolls when its computers broke down. Many went hungry or flocked to the churches for assistance. In Indianapolis, the police arrested Dennis L. Bunch when the Municipal Court's computers erroneously listed him as having missed a court appearance. Bunch spent eight days in jail before the computer error was finally rectified.

But the high-tech revolution also has its lighter side. After Sherlene Bloomquist wrote to the Sears Roebuck & Co. complaining about a 29 cent error in her account, the company's computers proved to be overgenerous — they credited her account for $161 billion.

The number of hardware- and software-related snafus grows daily. Some experts fear that in our rush to embrace the computer revolution, we may have neglected safety considerations. Computer errors, malfunctions and breakdowns pose a serious long-term problem that we have not as yet adequately addressed.

A study by the University of Minnesota Graduate School of Business Administration found that a majority of area corporations would be forced to shut down most, if not all, of their operations in the event of a serious computer shutdown.

In the case of a company with annual sales of more than $200 million, the study found that projected losses for the first week of downtime would exceed $90,000. Losses would rise to more than $800,000 by the second week and $2 million by the third. The researchers also discovered that human error, not natural causes, accounted for more than 80% of the system malfunctions. Humanity's overdependence on technology carries with it a heavy price. If H. G. Wells were alive today, he would warn us of the dangers of computer dependency.

Regardless of whether by error or design, technology that runs amuck can easily threaten the fragile fiber of our postindustrial society. We would do well to remember that the historian Arnold Toynbee has amply documented the rise and fall of 21 major civilizations since the rise of human settlements. The computer society could easily join the "junk yard" of history. As Toynbee has observed, civilizations are frail social, political and economic edifices lacking in permanence.

Computer breakdowns and malfunctions are now daily occurrences in business and government. One bank executive confided that such an error may have cost his bank $12 million. The U.S. General Accounting Office warns that computer breakdowns could result in both social havoc and a serious loss of life.

One such scenario almost happened when a faulty air traffic control computer caused a fully loaded passenger jet to fly for six miles at the wrong altitude in New York's crowded and dangerous skies. A federal official would later remark, "We were dangerously lucky." A South Korean 747 jetliner that accidentally strayed over Soviet territory as a result of a computer malfunction was not so lucky; Soviet jets intercepted it and shot it down.

The U.S. Senate Committee on Government Operations reported in 1976 that "computers make decisions that can cause incorrect actions for an extended period of time," and called on the federal government to secure its computer systems. The committee also documented numerous cases in which computers, made inoperable as a result of sabotage or human error, had caused both financial losses and human suffering.

In 1977, the Swedish Ministry of Defense, known for its calm and collected manner, added its voice to the chorus. One of its committees reported that the level of computer vulnerability in the West was unacceptably high, and warned that the West's growing dependence on computers increased its vulnerability to attack. Four years later the government was more specific — computer dependence has made the West extremely vulnerable to financial frauds, sabotage and terrorist attacks.

The U.S. National Security Agency (NSA), in a communique issued in August 1984 to more than 2,000 corporations, warned that computer systems were vulnerable to attack and sabotage by political malcontents and criminals. The Australian and Norwegian governments, as

ILLUSTRATION BY ROB SAUNDERS

well as England's Scotland Yard, the Federal Bureau of Investigation and the Paris-based Organization for Economic Cooperation and Development, have raised similar concerns.

Terrorists have started to attack computer centers, as well as use microcomputers to detonate powerful explosive devices.

But computer error or malfunction can cost as much as a criminal attack or sabotage. For example, in both November 1979 and June 1980, the Pentagon's computers rang a false alarm — "America is under Soviet missile attack." Fortunately, the error was discovered in time. In 1980, bank regulators in Massachusetts came close to closing 100 banks when the computers of a company that processed data for the banks malfunctioned. A fire at the Military Personnel Records Center in St. Louis destroyed much of the computer center, as well as 15 million records.

Experts note that our dependence is an outgrowth of two technological developments — dramatic improvements in computers and the proliferation of computer networks. In addition, the speed and storage capacity of newer computers make the timely detection and correction of errors and malfunctions difficult, time-consuming and costly.

To date, we have been lucky. No major computer-related catastrophe has befallen our society. But some would attribute this fact more to chance than to vision. Even the American Federation of Information Processing Societies, known for its conservatism, has called for a serious study of the risks posed by our computer dependency. Although difficult to quantify, we would be ill-advised to entirely dismiss informational catastrophes.

The Spanish Conquistadores had little trouble conquering the New World. They did it the easy way, by simply using the network of good roads that their Indian adversaries had constructed. Likewise, the electronic pathways of computer networks make our society vulnerable both internally and externally.

Groups opposed to technology date back to the early days of the Industrial Revolution. Small but vocal groups opposed to our high-tech revolution have likewise made themselves visible. One of the first of these was the International Society for the Abolition of Data Processing. Similar groups have sprung up in Western Europe and the UK. Some members of the high-tech community cavalierly dismiss these groups as individuals who fear the new and unknown — timid souls, afraid of change.

But this view underscores the fact that the high-tech revolution is regarded with apprehension by a sizable element within our society; many of these people are themselves members of the high-tech community. They fear that the electronic genie is fast taking control of our lives — that we may have glimpsed Pandora's secrets without fully understanding their ramifications. Our very privacy is at stake. The late U.S. Sen. Frank Church (D-Idaho) expressed his fears when he observed that there would be no place to hide in the computer society. Computer snooping can tell a great deal about us. It can lead to serious political manipulation.

There is reason for concern, especially as computers increasingly take over our daily lives. For example:

- Computers perform more than 100,000 calculations each second for every man, woman and child in the U.S.
- Our names pop up in some computer at least 40 times a day.
- Federal, state and local governmental agencies keep more than 35 files on each one of us, while the U.S. Bureau of the Census collects more than five billion facts about us.

Privacy and civil liberties are one and the same — one cannot survive long without the other. But privacy is fast becoming a thing of the past in our computer society.

- The NSA's computers eavesdrop 24 hours a day, seven days a week, on all overseas communications. NSA also occasionally monitors communications within the U.S.
- Much of the confidential data stored in the computer systems of financial institutions, retailers and manufacturers is vulnerable to unauthorized tapping.
- The computerization of our telephone system makes it very vulnerable to electronic snooping.
- As computer systems are linked to national and international networks, it will become even easier to track a person's movements.
- By using a device called an addressable converter, cable companies can now keep track of what programs a customer watches.

Rep. Robert W. Kastenmeier (D-Wis.) observed that "the essence of personal privacy protection is the assurance that private communications are protected." Sadly, this is not the case today. Our massive data banks and instant retrieval systems make George Orwell's telescreens seem ancient by comparison. All that is now missing is a giant network that would link all private and governmental computer systems into one. That, too, may be in the offing.

William B. Finneran, a member of the New York State Commission on Cable Television, has said that "the technical capability for collecting large amounts of personal information is already [here]." And computer pioneer Joseph Weizenbaum warns that we may be fast becoming a nation of sheep. Events may soon

COMMENT

Computers should serve to make our lives easier than they would otherwise be, given equivalent activities for us to perform without their benefit. Whether the application is in business, industry, government, science or medicine, that central goal of improved productivity and convenience remains the invariable test of a computer's usefulness.

Computers make managing W. R. Grace & Co. an entirely different ball game. Our computers help us track the performance of hundreds of industrial and restaurant units on a daily basis, permitting our executives to keep on top of massive amounts of data that would otherwise be unmanageable if contemplated on a by-hand basis.

The one point upon which Adam Smith and Karl Marx agreed is the definition of capital: stored labor. As we shift from an industrial to a service economy, stored labor ever more frequently takes on the form of stored information. Computers are thus becoming the dominant capital assets of future-oriented businesses.

Computers facilitate faster, information-grounded decision making. While I continue to feel that it is possible for managers to make mistakes in the computer era, they must make those mistakes in the presence of voluminous, often computer-provided, information. Computers have thus changed business by confining the potential for management error to the strategic, rather than the operating, realm.

No doubt the expanding role of computers will, in the 21st century, have a great, if not their greatest, impact upon medical research, diagnosis and treatment. While we have already seen gigantic advances in life-extending and life-enhancing technologies over recent years directly or indirectly attributable to computers, I believe it is safe to say, 'We ain't seen nothin' yet.'

Computers have an inextricable place in everyday activities, particularly in the numerous fields of biotechnology, in which unlocking genetic codes and duplicating or modifying them to increase agricultural yields and quality, for example, are simply impossible tasks without the benefit of computers.

I believe the 21st century will witness such conveniences as the ability to turn on an air conditioner in one's summer home by way of a phone call or the means for a do-it-yourselfer who was once a mechanical misfit to tune his own car. The predictable applications are as wide ranging as our imagination.

PETER GRACE
Chairman, W. R. Grace & Co.

....

"*Computerized incompetence:*
First Law — The computer may be incompetent itself — that is, it is unable to do regularly and accurately the work for which it was designed.
Second Law — Even when competent itself, the computer vastly magnifies the results of incompetence in its owners and operators.
Third Law — The computer, like the human employee, is subject to the Principle. If it does good work fast, there is a strong tendency to promote it to more responsible tasks until it reaches its level of incompetence."

THOMAS MARTIN
from *Malice in Blunderland*

prove both of them correct.

Today's limits are imposed not by our technology, but by our imaginations. For example, there are plans afoot to construct a computer that:

■ Talks and responds in many languages.

■ Is tuned to a person's brain waves.

■ Is small enough to be worn as a wristwatch, but powerful enough to communicate with other computers around the world.

Also planned is a chip that can hold two billion bits.

While the computer age has produced marvels, it has also produced disasters or so-called informational catastrophes. The consequences for our society could prove serious.

■ A computer catastrophe could bring more than 90% of all American businesses to a standstill within four weeks.

■ The Boston Water and Sewer Commission was forced to delay its billing by several weeks because of a faulty computer, costing it millions of dollars.

Fire damages

■ A fire at the First Data Corp. computer facility in Massachusetts resulted in more than $3 million in damages. More than 500 of its time-sharing customers went without service for more than a week.

■ A faulty computer in South Carolina was responsible for $55 million in unaccountable annual state expenditures.

■ The 1978 Santa Barbara earthquake made 12 key computer systems inoperable — some for up to 58 hours.

■ A government study concluded that an inoperable hospital computer may have been responsible for the death of at least one patient.

■ An IBM survey of 352 major computer breakdowns found that fire and flooding accounted for more than 60% of them; human error and bombings accounted for the others.

The causes of computer malfunction range from operator negligence to natural phenomena. Some experts believe that even electromagnetic changes generated by the human body can affect the workings of computers.

A survey of 500 Canadian users found that more than 40% had experienced some computer-related problem in the preceding year.

The unreliability of hardware and software is well documented. Yet both the American and Soviet military are toying with the idea of a launch warning system in which computers would be programmed to launch a nuclear attack, on their own, if their sensors detected approaching missiles.

Automation is fast displacing workers in the automotive and textile industries. By the year 2000, manufacturing jobs will account for only 11% of the labor force, down from nearly 24% in 1980. Agricultural jobs are also on the decline because of automation.

Robots in work force

By 1993, up to 1.3 million workers may lose their jobs as 260,000 robots enter the work force. A new elite, centered around information wealth, is on the ascendancy. The social dimension that will confront us in the coming years will be that between the "knows" and "know-nots."

The smokestack industries are not alone; computerization is also quickly displacing many white-collar workers. The news is not good for this last group:

■ Court stenographers in many states are now being replaced by computerized tape recording systems designed to keep track of proceedings in several courtrooms at once.

■ A strike in 1983 by 675,000 AT&T employees proved ineffective, largely because several thousand supervisory personnel were able to operate the telephone system with the aid of computers.

■ Striking Consolidated Edison workers in New York were not able to shut off service to the company's 3.5 million customers, largely because a small cadre of supervisors was able to keep the system going with the assistance of the company's computers.

The Industrial Revolution was responsible for profound social upheaval and widespread civil strife in Europe. The streets of Paris, Rome and Vienna became battlegrounds. Em-

ployee acts of sabotage became common.

Likewise, the computer revolution has witnessed, admittedly to a lesser extent, its share of employee sabotage and civil strife.

■ Angry employees in Great Britain have periodically threatened to destroy their employers' computers unless given a pay raise.

■ In Harrison, N.Y., a group calling itself the United Freedom Federation bombed the offices of one of the large local employers.

■ Angry public assistance recipients in Massachusetts have threatened to destroy the welfare department's computers.

■ Disgruntled workers sabotaged the weather service computers operated by the Metropolitan Life Insurance Corp.

■ Striking New York University employees threatened to destroy the school's $3.5 million computer center.

Keeping in mind that many of our high-tech companies are small, the majority employing fewer than 200 people, the question often asked of our high-tech prophets is, "Where will the millions of displaced workers find new jobs?"

As early as 1970, then British Prime Minister Edward Heath warned that the long-term threat to the West came not from nuclear war, but from civil strife.

Corporate snooping is not a new phenomenon. Companies have always wanted to know the business plans and strategies of their competitors; corporate intelligence gathering, although unethical, is often not illegal as long as the snooper doesn't resort to outright stealing.

Computer technology has made corporate spying easy. It is simple to buy information from one of the more than 2,000 data retrieval services in the U.S. For example, a data base service called Investext, published by Business Research Corp., will provide a subscriber with the full text of a research report prepared by a security analyst on a competitor. Selective Dissemination of Information, provided by Dialog Information Services, can give a subscriber an update on a competitor's data base. Economic Information Systems, published by Control Data Corp., can provide a subscriber with the locations of a competitor's plants, the number of people it employs, their estimated dollar volume output and their market share.

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Techno-ethics

An insurance company employee was found using his employer's computer to run a side mail-order business. A private investigator paid off an employee of the California Department of Human Resources to run a computer check on several individuals. Dismissed from his job, a disgruntled employee erased his fellow employees' computer files. In another case, a bank manager who was angry at a female employee for rejecting his amorous advances altered her computerized personnel record.

Breaches of techno-ethics in both the private and public sectors happen all to frequently. Unfortunately, there is a perception on the part of many private- and public-sector employees that it is okay to peep at a fellow employee's files, alter or delete data, copy software, leak confidential data and even use their employer's computer for personal business. The Data Processing Management Association has called for a "commitment to ethical behavior."

But what exactly constitutes proper computer ethics remains ambiguous. A survey of 100 corporations by the National Association of Accountants found that only 52% of those responding said their companies had any guidelines at all dealing with the use of computers; only 22% provided their employees with any written guidelines.

The Educational Fund for Individual Rights reports that more than 90% of the firms it has studied have no guidelines on what constitutes proper use of computers by their employees.

Slowly, both business and government are coming to realize that techno-ethics may need to be defined. It is dawning on management that an employee merely needs the correct password to access its most valuable trade secrets and marketing plans. Software manufacturers are threatening to bring legal action against employers who permit the copying of their software. Some consumer activists are calling for federal legislation, and private individuals are bringing a plethora of lawsuits against businesses that have failed to safeguard their computers.

Most companies have done little, if anything, to address the problem of computer data security. When they have tried, their guidelines are often both cosmetic and ambiguous.

■ Company A's guidelines specify that computers should not be used for private purposes; they fail to specify what constitutes a "private purpose."

■ Company B prohibits its employees from misappropriating computer time but fails to define what constitutes "misappropriation."

■ Company C allows its employees to take their computers home, provided they use them only for company-related business; it fails to specify what constitutes authorized company business.

Desktop computers now give every employee access to voluminous information on a multitude of individuals both inside and outside the organization. Ensuring that an employee does not abuse this power can often prove difficult; it could even constitute an invasion of privacy if, for example, it involved the electronic monitoring of computer use. While union officials look askance on electronic monitoring, somehow the widespread preception that it's acceptable to snoop into computer files and electronic mail needs to be changed.

Like all myths, the high-tech myth has its vision of a better society. The proponents of automation, through their advertisements and public relation firms, remind us daily that computerization will make us happier, rejuvenate our ailing industries, eradicate racial and class differences, give rise to a generation of superchildren and allow us to work in the comfort of our homes.

Some critics charge that, in fact, computerization has merely introduced a new form of tension in our lives — techno-stress.

Techno-stress is one of those buzzwords that merits watching. It refers to many of the health-related ills connected to working with computers — its existence has been confirmed by research. For example, the National Institute for Occupational Safety and Health has reported that some of the most stressful jobs today involve computers. A survey by the National Association of Working Women found that female VDT operators suffer a disproportionate number of miscarriages, deaths of newborn infants, children born with defects and premature deliveries.

A study of 26 computer centers both in the U.S. and Canada by the Data Entry Management Association found that computer operators and clerical employees at the centers complained of back pain, nervousness, fatigue, neck and shoulder pain, burning eyes, stomach pains, skin rashes, swollen muscles or joints and eyestrain.

Harmful doses of radiation

There is evidence that some of the existing terminals may emit harmful levels of radiation. But computer industry sources deny these claims; they dismiss the evidence as dubious. They charge that these studies were conducted by people and groups unfavorably disposed to the computer industry.

Among the other ills connected with computerization is the sense of isolation and loss of

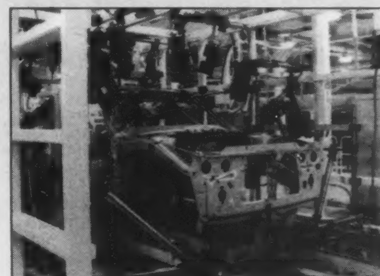
HANDS-ON

An efficient, but risky, assembly line

When something goes wrong with a piece of machinery at Chrysler's assembly plants in Windsor, Canada, Sterling Heights, Mich., or Dodge City, Mich., it takes four or five seconds for the computerized factory information system to alert repair personnel. At the same time, the system diagnoses the problem and identifies its location. If the problem requires replacing a part, the system tells the repair person exactly where, in the plant, he can get it.

Chrysler will spend $12.5 billion over five years on new products and manufacturing techniques in order to help it compete in a global market says Bob Duran, manager of the factory information system within Chrysler's Manufacturing Group.

At the heart of that effort is the factory information system at these three plants. Each plant has a cluster of IBM Series 1 minicomputers arranged in a chat ring for high-speed communications with a variety of front-end microprocessors, terminals and monitoring instruments.



Laser beams check dimensions of each auto body.

In addition to maintenance diagnostics, these plantwide systems continuously monitor the status of all manufacturing equipment to detect potential problems like degradations in running speed. Preventive maintenance is an absolute necessity, since Chrysler has redesigned the plants to support in-line sequencing.

This efficient but risky method of assembly sends each car through the process in an uninterrupted, two-day, six-mile sequence. If one machine along the way breaks down, if one part is not at the proper station at the proper time or if one operation fails to pass the inspection of laser cameras positioned to examine the more than 350 points on the car body, the whole line grinds to an instant halt.

Employees who spot any problems can also feed that data into the plantwide communications systems through hundreds of on-line terminals. This performance feedback system also interfaces with the memory bank of electrical test equipment for the steering column and instrument panel.

Chrysler uses robots extensively in each of the assembly plants for tasks that include welding, installation of roof panels and sealing of windshields and rear windows. Computerized equipment also performs other jobs, such as applying alignment and torque to front suspensions.

Before Chrysler has finished, it will have revamped four other auto assembly plants as well as its power train and stamping plants. And even then, the process probably won't be finished.

"One of our objectives," Duran says, "is to enhance the process a little more each time we bring up another plant."

The benefits of this investment and effort are, however, significant. "With the new equipment and new systems," Duran says, "Chrysler is increasing machine up-time by 15%, reducing scrap and improving quality in terms of first time through acceptance by similar amounts and reducing tooling and other manufacturing expenses by at least 10%."

COMMENT

Science fiction and utopia writers from H.G. Wells to Ursula Le Guin have written about the computer as a liberator. They imagine computerized societies where work is less arduous and time-consuming. They see people free to use their minds in creative ways and their time to perform interesting and varied tasks.

At 9to5, we think these are wonderful visions. And we believe computers could benefit both workers and work. Unfortunately, what we find in the automated office is much less than ideal.

Here is what we would like to see — and what we think is possible.

First, we want more say over the quality of our jobs. The great beauty of the new technology is its flexibility. It gives us the opportunity to carry out work in dozens of ways. And we want this flexibility to be used to create jobs rich in variety, responsibility and authority.

We want the technology used to build a work force that has many rungs in its job ladders. We are currently moving toward a polarized work force with jobs at the top for a small elite and dead-end jobs at the bottom for the rest of us.

One way to get office workers to move up that ladder is to train them to use a full spectrum of skills on the new equipment.

We must move toward better pay. Today, the computer enables companies to increase productivity at the bottom line, but those of us who are speeding up the output and intake are not reaping the reward. We deserve upgraded job descriptions and paychecks to match our contributions.

We deserve healthy work places. Space-age technology should not be a hazard to workers' health. We need safe office design, along with a system of work breaks and job rotation, so that we don't lose our eyesight, the use of our hands or our mental health.

Most of all, we would like management to work with us to create an office we look forward to going to, where we use our minds, where we earn enough to feed our families and where we won't get hurt in the process. Does it sound like utopia? We think it could be our reality.

KAREN NUSSBAUM
Executive Director, 9 to 5

control it produces in some workers. The use of computers to keep track of worker productivity — how many breaks they take, the number of phone calls they make and how fast they type — merely aggravates such feelings. Even some industry sources will privately acknowledge that techno-stress is a problem.

In 1982, IBM entered the infant-robot market with a one-armed programmable robot system that could be connected to a personal computer. The Japanese have unveiled a robot that is capable of reading books to the blind. General Dynamics Corp. is constructing robots that can be programmed to train marine mammals.

Robots have arrived. Guided by artificial intelligence, they will soon run factories and hospitals, mine the deep seas, explore space, perform rescue missions, attend to agriculture, teach in our schools and tend to our cows. Robotics, however, is still in its infancy.

Up to now, Japan has been the leader in this field, followed closely by the U.S., West Germany and Sweden. And the U.S. is catching up fast. Our robot population is expected to reach 72,000 by 1988; experts forecast it will exceed 260,000 by 1993. But robotics also carries with it a human price tag — before the end of the century, one-third of America's work force may find itself replaced by robots.

Guided by artificial intelligence, robots will soon run factories and hospitals, mine the deep seas, explore space, perform rescue missions, attend to agriculture, teach in our schools and tend to our cows.

Robots are the shock troops of the Computer Age. Plans are on the drawing boards to develop an entire generation of sophisticated home robots that could become standard household fixtures by the end of this century.

However, robots are more than merely mechanical servants; they are the link between the computer and the world at large. They are guided by a microcomputer that can be programmed to direct them to perform specific tasks. Once programmed, they often need little human intervention.

Dark side

But robotics also has its dark side. When computer brains malfunction, disaster can ensue.

- A malfunctioning computer at the University of Florida's Center for Intellectual Machines and Robots caused a robot to go berserk and destroy valuable property.
- In Japan, a malfunctioning robot killed one of the mechanics sent to fix it.

Experts predict that by the end of this century, robots will possess many human attributes. They will be able to distinguish human voices, smell smoke, taste food and, armed with artificial intelligence, even duplicate our innermost feelings. There is even talk in some legal circles of enacting a bill of rights for robots. The robots are fast taking over.

The daily newspapers carry stories about test-tube babies, but scientists are looking even farther down the pike to a generation of test-tube computers. The idea is to use genetics to turn molecules and bacteria grown in a laboratory environment into powerful computer circuits — in other words, to replace the billions of molecules that now make up a silicon chip with a single laboratory-grown molecule; to construct super-sophisticated computers. The Japanese, quick to see commercial opportunity, are fast moving into this area.

'Living' chips planned

Plans are also on the drawing board in the U.S. to construct living computer chips. Researchers at the National Institute of Health have already isolated amino acids, the building blocks of life, that can be used to construct powerful living computer chips. EMV Associates, a high-tech research firm based in Rockville, Md., plans to have a prototype of the amino acid-based computer chip within the next five years.

These living chips would be more than one billion times as powerful as their silicon counterparts. Visionaries also dream of implanting living chips between neurons in the brain, giving it the ability to communicate directly with computers. There are even plans to turn brain cells into tiny computers and link them to giant communications networks, enabling the brain to communicate with computers many thousands of miles away.

Science fiction writers have pictured a future with colonies in space, floating cities in our oceans, super-human robots and genetic engineering. All this is the offing, and it will be made a reality by the computer revolution — by ultrafast computers that think and communicate not only with other computers but also with humans. But the Computer Age also raises disturbing legal, moral and political questions. High-tech America needs revisiting.

Bequai is a Washington, D.C.-based attorney. Excerpted from Techno-Crimes, *copyright 1987, D.C. Heath and Co. Published by Lexington Books.*

Walter Wriston

The information explosion and the global marketplace

CW PHOTO BY P. CHARLES LADOUCEUR

Walter Wriston created the world's leading international banking institution and revolutionized the global banking environment in his 17 years as chief executive officer of Citicorp.

Though he retired as Citicorp chairman in 1984, Wriston still works out of the corporation's executive headquarters in New York. He is chairman of the President's Economic Advisory Board and director of the Council on Foreign Relations, Inc. In an interview with Computerworld *senior writer Michael Sullivan-Trainor, Wriston presents his views on the role computers play in the success of American business.*

What are the major ways computer technology has changed the nature of business?

WRISTON: The major thing it has done is create a global marketplace by tying the world together through an electronic infrastructure. This is the first time in history that has happened. What that means is that America is a big market, but it is only a subsection now of a global market, and the impact on business and business management is tremendous.

How does that affect American businessmen, being part of a global marketplace?

WRISTON: It means, for example, that it's a matter of indifference now to an American chief financial officer whether he raises his capital in New York or London or Hong Kong. He goes where the best deal is, and it can be done literally in hours where it used to take sometimes weeks or months.

The second thing that technology will do is flatten all corporate organizations by removing layers of management. The assembly line really created middle management by having folks around who made sure the fender got to the right place at the right time and so forth.

If plants are now run by digital-controlled tools, those people's jobs tend to become redundant. If people have CRTs on their desks from which they can call up information on sales and inventory or whatever, they don't have to go and ask their former boss about those things. So I would predict that many layers of management will be eliminated over time by the information explosion.

Is there a tendency now for businesses to rely too heavily on the use of computers and information technology?

WRISTON: I think we have jumped over that point. We're at the point now where you can't go back again. The 200 million shares traded each day on the New York Stock Exchange couldn't be handled by clerks any more than the switching centers of the telephone system could be handled by operators. There aren't enough people in the world. You can have some nostalgia for yesterday, but we're not going to go back there.

So it's gone beyond the point of wanting to use this technology — it's a must-use situation now?

WRISTON: Exactly. I believe that corporations will over time appoint chief information officers, just as we today have chief financial officers. They may be one in the same person, but we'll see a marriage of competitive market data with internal MIS.

With the U.S.'s technological edge, why is American business still losing out to foreign competition in certain markets?

WRISTON: Our lead in technology is on the innovative side, the inventive side, while the Japanese tend to lead on the manufacturing side. In the moving of the technology from the laboratory to the production line, I think we may be slightly behind. We just haven't put our minds quite as much as we might have on the manufacturing side, but I think that is rapidly being repaired.

Where would you rank the use of information technology as a factor in Citicorp's ability to be competitive? Is it the most important factor?

WRISTON: No. The most important factor is the quality of the people. That's the most important factor in any business. Information is just a tool. The quality of the tool, its sharpness, its timeliness is very important. Whether the information is built by a fellow writing on a yellow pad with a pencil or whether it comes up on the screen, it's still a tool.

When you were Citicorp's CEO, did you push for an increase in the investment in data processing or information technology?

WRISTON: Not in data processing alone, but we were spending several hundred million dollars on technology which covered everything from expert systems and formatting money transfers to transponders on the Westar Satellite and hardware and software for good response times on credit cards and cash machines. We spent a great deal of money on it. We still are.

Citicorp's new CEO comes from a computer background. Is his appointment recognition of the importance of technology to the company?

WRISTON: He knows much more about it than I do. He has a better understanding of the market picture, for example. There's over a trillion dollars every day that changes hands in the New York markets, not counting the stock market. So understanding how to account for that, control it and keep track of it is clearly a technical problem.

Where is this technology taking us?

WRISTON: What's going to happen is the interface between man and machine is going to get easier. What is laughingly called user-friendly software is going to evolve clearly into the spoken word, and there will be very much more simple ways to access, display and manipulate data than we now have.

So basically, the tool will be easier to use. But do you think the impact of computer technology on business will be any different than it is now?

WRISTON: We will have greatly accelerated more of the same. I think that expert systems and artificial intelligence will become more the norm. You'll see expert systems selling products on screens in bank lobbies.

A person would go up to one of these machines and ask about a complex account and he can query: What is the interest on the balance, do I get checks free, can I invest it in a tax free fund, can I fix it so my checks won't bounce, can I do brokerage transactions? Anything anybody wants to know, the machine will tell them.

Will the resistance to technology lessen as it becomes easier to use?

WRISTON: Sure. I watch my 8-year-old grandson sitting in front of a Macintosh computer and it makes me feel a little inadequate. We're training a whole generation of people. My generation grew up with a pencil and a pad, and the next generation had a big argument whether hand-held computers were legal in classrooms.

This generation growing up now will think absolutely nothing at all about using a personal computer as a tool for all kinds of things. They'll be as computer literate as we were arithmetically literate.

Quill-pen days vs. oh-so-easy word processing

BY RUSSELL BAKER

For a long time after going into the writing business, I wrote. It was hard to do. That was before the word processor was invented. Whenever all the writers got together, it was whine, whine, whine. How hard writing was. How they wished they had gone into dry cleaning, stonecutting, anything less toilsome than writing.

Then the word processor was invented, and a few pioneers switched from writing to processing words. They came back from the electronic frontier with glowing reports: "Have seen the future and it works." That sort of thing.

I lack the pioneer's courage. It does not run in my family, a family that arrived on the Atlantic beach 300 years ago, moved 50 yards inland for security against high tides and has scarcely moved since, except to go to the drugstore. Timid genes have made me. I had no stomach for the word processor.

Still, one cannot hold off forever. My family had given up saddle and stirrups for the automobile, hadn't it? Had given up the candle for the kerosene lamp. I, in fact, used the light bulb without the slightest sense of betraying the solid old American values.

And yet . . . my trade was writing, not processing words. I feared or detested almost all things that had "processing," "process" or "processed" attached to them. Announcements by airplane personnel that I was in a machine engaged in "final landing process" made my blood run cold. Processed words, I feared, would be as bland as processed cheese.

So I resisted, played the old fuddy-duddy progress hater when urged to take the easy way and switch to processing words.

When former writers who had turned to processing words spoke of their marvelous new lives, it was the ease they always emphasized.

So easy — the processing process made life so easy (this was what they always said) — so infinitely easier than writing. Only an idiot — and here I caught glances fraught with meaning — only an idiot would continue to suffer the toil of writing when the ease of processing words was available to be wallowed in.

To shorten a tedious story, I capitulated. Of course I had doubts. For all those years I had worked at writing only because it felt so good when you stopped. If processing words was so easy, would there be any incentive left to write?

Why are we moved to act against our best judgment? Because we fear public abuse and ridicule. Thus the once happy cigarette addict is bullied out of his habit by abuse from health fanatics, and the author scratching away happily with his goose quill puts it aside for a typewriter because he fears the contempt of the young phalanxes crying, "Progress!"

My hesitation about processing words was being noticed by aggressive young persons who had processed words from their cradles and thought the spectacle of someone writing was as quaint as a four-child family. I hated being quaint. I switched to processing words and — man alive! Talk about easy!

It is so easy, not to mention so much fun — listen, folks, I have just switched right here at the start of this very paragraph you are reading — right there I switched from the old typewriter (talk about goose-quill pen days!) to my word processor, which is now clicking away so quietly and causing me so little effort that I don't think I'll ever want to stop this sentence because — well, why should you want to stop a sentence when you're really well launched into the sentence — and it's so easy just to keep her rolling and never stop since, once you do stop, you are going to have to start another sentence, right? — which means coming up with another idea.

What the great thing — really great thing — really and truly great thing is about processing words like this, which I am now doing, is that at the end, when you are finally finished, with the piece terminated and concluded, not to say ended, done and thoroughly completed to your own personal, idiosyncratic, individual, one-of-a-kind, distinctive taste, which is unique to you as a human person, male or female, adult or child, regardless of race, creed or color — at the end which I am now approaching on account of exhausting available paper space the processing has been so easy that I am not feeling the least, slightest, smallest or even somewhat minuscule sensation of tired fatigue exhaustion, thus being trapped into the time-wasting thinking process, which just about does it this week, spacewise, folks.

Could a PC ever work like a TV?

BY DAVID KAY
President, Kaypro Corp.

Let's face it. The personal computer, as powerful and versatile as it is, has a long way to go before it's thought of as a member of the family. Granted, it is a highly useful tool on the desktops of U.S. business. For word processing, data base management and financial analysis, there's nothing like it. But for all the promises, all the hoopla about computers changing our lives, I am not convinced.

For most people, the television, the automobile and even the VCR play a much more prominent role in the daily routine. However, those of us involved in the shaping of the industry's future are certainly looking to change that. We are busy working on critically important ideas for business and industry that should help fulfill some of the great expectations that were expressed when microcomputers came on the scene.

For example, anyone who has heard the standard PC's "music" knows it is to music what air freshener spray is to the scent of a rose. These rudimentary beeps, squeaks and trills are a reminder of just how far we have to go.

The computer has the potential to be as entertaining as the TV, as educational as the classroom and as easy to operate as the VCR — maybe even more so. But it will take some work. And, as in the past, the natural migration of computer advancements is from aerospace and other industries to business and, finally, the home.

Because of the rapid changes in technology, we need to build computers that do not become obsolete the minute something "new and improved" hits the market.

Another important step for our industry is to build more standard functions into computers. I often hear people complain that they were led to believe that computers could perform myriad tasks. They buy one, take it home or to the office, plug it in — and wait for it to do magic.

Without software and some skill in running them, computers are not too exciting. We are working toward more standard functions, such as quality sound, word processing and printing, networking and a whole lot more. In addition, we would like to reduce the amount of time (and the amount of reading) it takes to get comfortable with these boxes full of promise.

Certainly, all of us in the important and changing industry are working to perfect our products. We are also paving the way for the next generation of computers.

In the next five to 10 years, we will see an appreciable growth in expert systems — software programs capable of certain types of decision making. But this powerful software makes some demands on computer hardware that the current generation of computers will have trouble satisfying. More random-access memory and huge increases in the speed of program execution will be needed to bring expert systems into the workplace.

The computer has the potential to be as entertaining as the TV, as educational as the classroom and as easy to operate as the VCR — maybe even more so.

The computer has found its natural habitat in business. However, in the next decade, we all must work to expand the market. To do this may require rethinking the way we interact with the machines.

In addition to better, more ergonomically logical keyboards, we are evaluating voice-activated systems, touch-screen advancements and other more familiar methods of interaction. Computer controls may someday work like those of a TV or VCR. To change a program, you'd change the channel.

With both computer hardware and software, we have reached a phenomenal level of sophistication — yet it is only natural to press for more.

We need greater memory capacity, vastly improved software and more to begin to fulfill the promise of the computer age. To ask computers to be smart — to perform even the most elementary of tasks, like telling the difference between a dog and a cat — is still more a challenge than a reality.

But, conveniently, just as in the ending of *2001: A Space Odyssey*, we are in the driver's seat. Through our imagination and our willingness to work out the bugs, the computer can continue to release us from drudgery and fulfill more of its promise.

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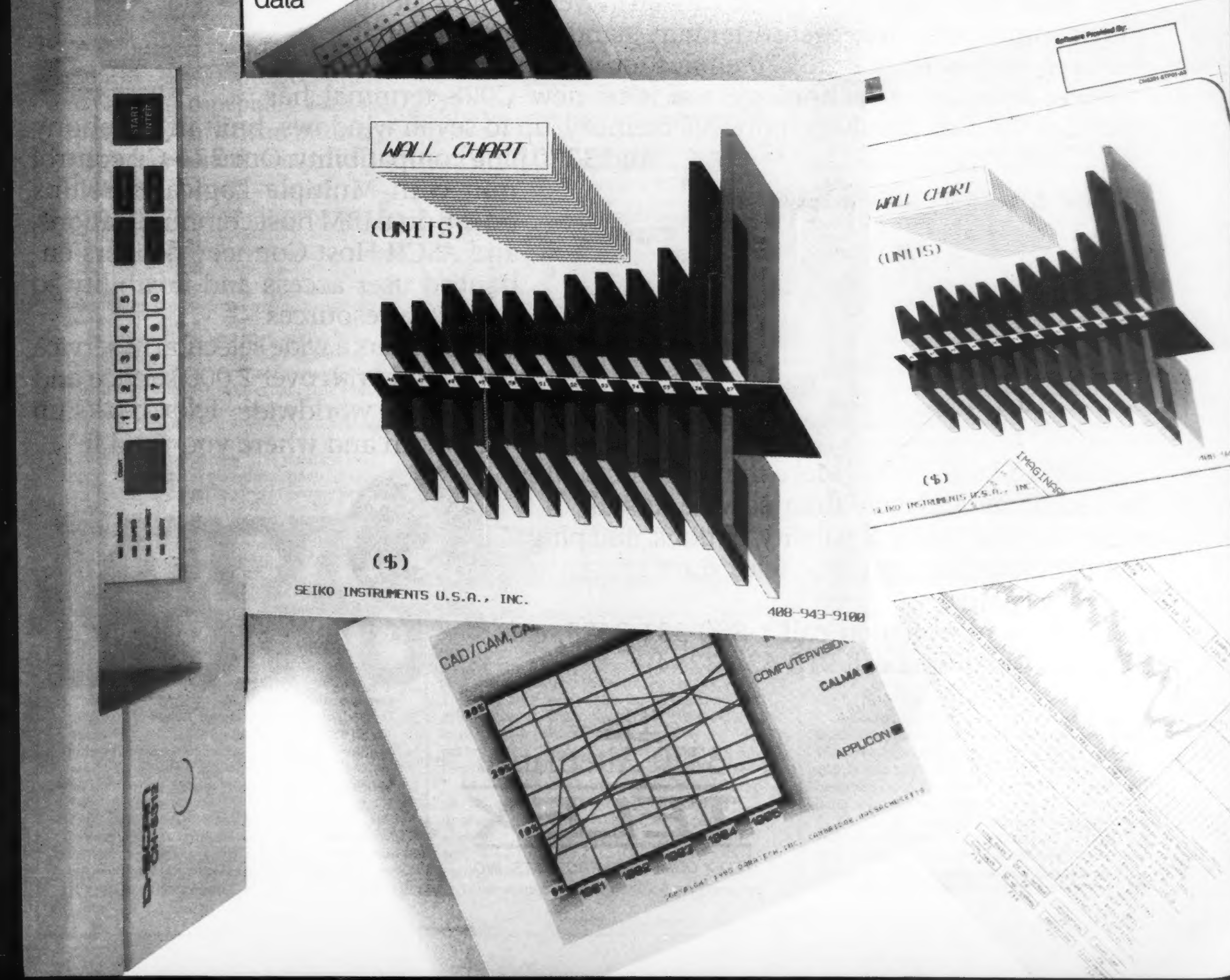

Learning to learn: Changing our schools

Today's demanding information age requires world-class educational system in the U.S.

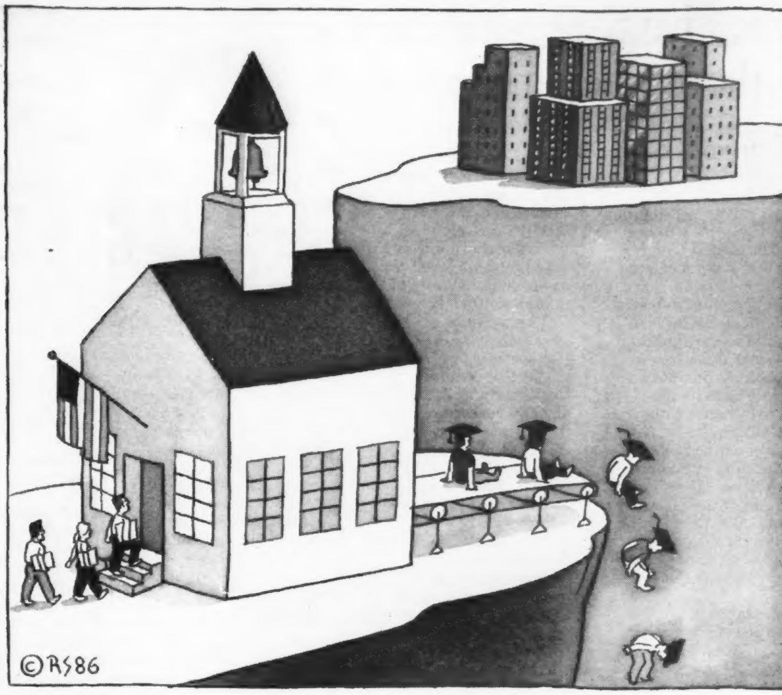

ILLUSTRATION BY ROB SAUNDERS

BY DAVID KEARNS
Chairman, Xerox Corp.

Over the last decade, we've all seen and read stories about America's widening competitive gap — especially with the Japanese. American industry has worked hard to narrow that gap, and we've made some pretty decent progress so far. But in the long run, none of it will do us any good if we don't narrow the education gap in our public schools. Indeed, most experts agree that the basic reason for Japan's extraordinary economic growth is its education system.

Japanese high school students have the highest measured IQs and the highest test scores. Ninety-five percent of them graduate with a high school diploma that is the equivalent of two years of college in this country. There is no question that the Japanese have the best educated work force in the world. That's where our competitive position will suffer the most, because our schools are simply not turning out the kind of people we need.

The American work force is in grave jeopardy — and so is our economic survival. As a businessman and as a citizen, that alarms me. It should alarm everybody else in this country, too. Every year, our high schools turn out 700,000 functionally illiterate graduates; 700,000 more drop out every year. In 16 states, dropout rates range from 26% to 42%, with most big cities falling in the high end of that.

A recent study by the National Assessment of Educational Progress found that only two out of five students could draw correct inferences from a set of facts, and only one out of seven could write a good essay. In 1972, 64,000 young people had Scholastic Aptitude Test verbal scores of 650 or higher, but in 1982 that number was cut by more than half to only 29,000. In math scores, the decline was 23% for the same group. There has been some improvement in those numbers recently, but it's not nearly enough.

The failure of our schools to teach adequate basic skills is imposing enormous costs, and business is paying a big part of the bill. American business will have to hire more than a million new workers a year who can't read, write or count. Teaching them how, and absorbing the lost productivity while they're learning, will cost industry $25 billion a year for as long as it takes — and nobody seems to know how long that will be.

Three out of four major corporations are already giving new workers basic reading, writing and arithmetic courses. Corporations spend $210 billion a year on training — at Xerox, we'll spend $210 million in 1986, alone. It's hard to believe, but adding $25 billion a year for remedial training has become a necessary cost of doing business.

Even without the high cost of remedial training, industry's training bill will keep growing, because we are entering an era of lifelong learning that merges work and education. The office, not the factory, is the center of our working lives. The backbone of the new American work force will be people who deal mainly with the formation and refinement of ideas. Most jobs will be restructured at least once every seven years. By 1990, three out of four jobs will require some education or technical training after high school.

We'll need people who have learned how to learn. We'll need people who can absorb new ideas, people who can share those ideas easily with others. All of us will have to deal with more information faster, because it is the commodity that provides the competitive edge.

I'm a businessman, not an educator, but it seems to me that we have to rethink our education system from the ground up. The people who will run our companies and our government and our institutions in the year 2000 are here today — in kindergartens and grade schools and high schools. We should look at some radically different ways of educating those children and some radically different ways of running the schools they're in.

Business is often accused of having a myopic vision that can't see beyond the next quarter, and I'll admit that there's probably some truth to that. But this is one issue on which we're all going to have to take a long-term view.

If we want to have sustained progress, we have to recognize that changes are no substitute for structural reforms. At Xerox, for example, we realized that we couldn't beat our Japanese competitors just by tinkering with our production methods. So, we revolutionized the way we do things. We restructured everything — from the way we manufacture to the way we design, even to the way we think. We reorganized our entire organization to become more productive and more effective.

I think our public schools have to do the same thing. Public education is the most hierarchical institution we have left in this country. Schools are still organized on the factory model, with students rolling along assembly lines. That worked when industry was organized the same way. But today, business is adopting leaner structures and greater autonomy for workers, professionals and managers. Just as business had to reorganize to meet competition, our schools will have to reorganize to do the job society needs them to do.

You can't build a world-class company on outmoded organizational structures. We've learned that in American business. And you can't build a world-class education system on outmoded structures, either. But it seems we've yet to learn that in American education.

Why can't schools organize themselves the way the best high-tech companies do — with flat, lean structures that bring them closer to their customers and encourage creativity and responsibility? Why not operate year-round, stay open beyond the hours of nine to three and teach a core curriculum of the skills our economy needs? Above all, why aren't schools demanding more from our children — more achievement, more accountability?

The kinds of changes I'm talking about aren't going to happen overnight. Reform and reorganization are long-term goals that could take an entire generation to achieve, and I don't think we have that much time.

Business has the biggest and most efficient training system in the world already in place. We can continue to use it to help bridge the gap, but in the long run, I'm convinced that business cannot — and should not — provide basic education for its employees.

That task belongs to the schools, and we've got to help make them do it and do it right. We don't really have a choice, because the quality of our work force is a survival issue for America.

Executive systems catch on — the second time around

BY RICHARD CRANDALL
President, Comshare, Inc.

Executives' use of information systems will produce the biggest payoff the computer has yet offered to the corporation.

The computer industry was built on the tactical and production applications needed for day-to-day business operations.

While highly valuable in their own rights, financial accounting systems, payroll, production control and the like have done little to answer the strategic questions of the executive, including:

What are the profitability trends of the most recent products in the market?

What is the pro forma return on investment of the acquisition we are considering?

Where are the five largest deviations from product quality goals and what is the forecast trend?

With answers to questions like these, executives using good judgment can save or earn millions of dollars for their company.

Twenty years ago, the first management information systems failed because of the poor condition of the underlying data. Now, after 20 years of refining the operational systems, there is so much data the executive is drowning in reports. Executives ask for less, not more. They want information that is relevant for strategic uses and delivered quickly.

Today we are on a threshold in the market. Under the new banner of "executive information systems," we are beginning to serve the higher level executive who is untrained in computer use. Using the distributed power and ease-of-use possibilities of the personal computer and the touch screen, we are providing executives with fingertip access to information on critical success factors strategic to their business operation. And this time, 20 years after the first attempt, it's working.

HANDS-ON

Factory automation and jobs, too

Factory automation does not always mean worker displacement. General Electric Co.'s Major Appliance Business in Louisville, Ky., proved this with a major overhaul of its dishwasher manufacturing plant in 1983. The project was the pilot for a five-year plan involving a $1 billion investment and all six appliance plants in the Louisville manufacturing complex.

GE spent $60 million on redesign and retooling. Roughly 60% of the assembly and subassembly areas was affected, with automated systems installed for materials handling, production tracking and inventory control. The company brought in robots to handle heavier or less desirable jobs such as spray painting. But not all of the money went into automated systems; some went to preconstruction engineering of an improved product.

"We didn't just automate the process," says James Allen, manager of communications and community relations. "We did it in conjunction with an effort to improve the product." And that, he adds, is probably one of the key reasons that post-automation increases in business were great enough to keep employment stable. The dishwasher plant employed 1,500 people before automation. Today, with the same number of employees, the plant produces more than 100,000 additional units per year.

Layoffs were unnecessary, according to Allen, because GE's share of the dishwasher market also increased from 30% to 40% after both product and plant were redesigned. Consumers reportedly like the new and lighter plastic washer frame. They may also have been influenced by the improved reliability resulting from automated manufacturing controls that allow quality checks at every stage of the assembly process. Not only is GE having to scrap 20% to 25% fewer parts because of machining errors, he says, but the service call rate has been halved.

GE does not claim that factory automation will never result in layoffs or even that the same happy combination of high tech and full employment can be duplicated in all of its Louisville appliance plants.

"All we are saying," Allen explains, "is that given a favorable economy and proper planning, automation can actually bring about enough of an increase in business to create new jobs for the ones it has replaced."

COMMENT

At Rockwell International, as with other large organizations today, computers have become integral to our management systems and procedures.

Supercomputers handle complex analysis; mainframes store and analyze basic business data; computer-aided design and manufacturing and computer-integrated manufacturing installations increase productivity and quality in manufacturing operations; and minicomputers are used in many applications throughout our plants, research facilities and offices.

Personally, however, it is the microcomputer which most directly affects my business day. Micros provide the memory, access to key commercial data bases and communications capacity for me to accomplish more in a few minutes than I could in hours before.

Reports, files and itineraries are at my fingertips and always up to date. I can stay current minute by minute on our company's performance and that of competitors.

Details on fast-breaking news events affecting the business may be retrieved easily. And when those events generate additional questions, a quick query to a data base comes up with the anwers.

In short, the microcomputer keeps track of the detail with minimum personal effort and keeps me in touch with events outside the company.

Without question, the computer has become an indispensable tool in every facet of our business.

ROBERT ANDERSON
Chairman, Rockwell International Corp.

Renaissance, revolution & MIS tyranny

Technical pioneers may regret it, but computing is out from the glass wall

BY EDWARD ESBER JR.
Chairman, Ashton-Tate

I met my first computer when I was in high school in Cleveland. It wasn't *my* computer — it was a mainframe somewhere at the other end of the phone line, and I had to share it with strangers. This was the late 1960s, the Middle Ages of computing, when we huddled like cloistered monks safe in the knowledge that we had cornered the market on computer literacy.

I knew then that computing would change my life. But few anticipated what would follow so quickly. Computing experienced a renaissance (the emergence of microprocessors and the new breed of entrepreneurs of the 1970s), wars of liberation (the personal computer revolution), and now, the Enlightenment (the pervasive role of personal computing in corporations, smaller businesses and the home).

And it has changed the lives of millions. The barriers have fallen; computing is for the masses, and there is no turning back.

Dramatic changes

The personal computing industry itself has changed dramatically since the day I created my first Visicalc spreadsheet. The founders of microcomputer software companies and the original PC hardware companies were counterculture mavericks. And the first users were technical hobbyists and early adopters.

They took their PCs to their offices and used them to bypass the bottleneck of the mainframe CPU. Co-workers followed suit, and a micro revolution was under way, waged against unusable software and inaccessible computer resources.

Times have changed. The personal computer is a serious business tool. Users are not technical pioneers but professionals who need a productivity tool to solve their business problems. Expenditures for micros and PC software have reached a significant level in corporations.

While microcomputer software companies have caused fundamental changes in the computer software industry in terms of computer accessibility and software usability by a broader audience, the leading companies of tomorrow will be computer software and services companies. The major distinctions between software for microcomputers, minis and mainframe computers have already begun to blur.

There are people today who, like old revolutionary cadres, claim that the personal computer revolt is over. They long for the old antiestablishment days. They lament that microcomputers today have become an integral part of corporate computing.

Well, it is true that the days of scrawling "Up against the wall, MIS" on the washroom walls have passed. But the PC revolutionaries won! Personal computer users are less elitist than ever before. Corporate America has embraced personal computing.

More important, it has embraced the concept that people need the power, accessibility and independence of their own computer on their desktop.

And to those who complain about the tyranny of MIS, I maintain that the person in the next office has as much influence over what software package someone uses as anyone from on high.

Vendors and micro managers are both focusing on new issues: user productivity, user support and connectivity, to name a few. A new results orientation is driving the development of new technologies — from the multitasking capabilities and graphics metaphors of new operating systems to the linking of personal computers to larger systems to run new applications and to access corporate data.

Meanwhile, the barriers to computing continue to fall. As the 21st century approaches, personal computers will be used by a broader range of people and will become a transparent part of our environment. My children's level of computer literacy will make my generation look like cavemen.

Using computers and accessing information from data bases will become more natural and less obtrusive.

And as computer literacy becomes more widespread and people become more information rich, their potential as individuals will continue to expand.

HANDS-ON

Need consumer support? Check with the data base

At the Center for the Study of Services, a nonprofit consumer information organization in Washington, D.C., 10 personal computers churn out dozens of varieties of price and value analyses on everything from plumbers to long-distance telephone services.

Until a little more than a year ago, the 12-year-old center owned a couple of Kaypro Corp. computers but did most of the ratings and comparisons for its consumer guides and publications by hand, relying on a service bureau for occasional help with large surveys. Today the center's equipment includes several IBM Personal Computers and PC XTs, a couple of Compaq Computer Corp. portables and four Leading Edge Products, Inc. microcomputers.

What pushed the center into full-scale deployment of microcomputers for consumer advocacy was the decision to provide a new and more personalized type of service — helping consumers choose a long-distance carrier.

Telephone customers can now send their call records to the center and obtain an analysis of what they could expect to pay for comparable service from each of the carriers vying for their business. The service runs an analytical program specially created for the purpose in Ashton-Tate's Dbase III. Fees start at $10 and increase with the length of the billing records.

According to founder and President Robert Krughoff, this service, which has already been used by between 5,000 and 6,000 consumers, represents just one of many instances in which computerization enhances the center's ability to inform the public.

"We did a supermarket survey in May that covered the two areas where we publish our *Consumer's Checkbook* magazine — the Washington metro area and the San Francisco Bay area," Krughoff says. "For each area, we compared about 35 supermarkets, looking at roughly 130 items. But we didn't stop there; we also ranked them on pricing for individual categories like meat as well as the whole market basket and even included a section showing what the impact would be if supermarket brands were substituted for major labels."

Krughoff estimates that computerization has increased the center's own value by 10% to 20% in terms of the information it can provide to consumers. "It is particularly important," he says, "in situations where there is no single right or best answer, because the needs of each consumer are different."

In addition to long-distance telephone selection, many other areas could be addressed. "I can see the same needs existing in terms of shopping for various kinds of insurance," he says. "And even when it comes to supermarkets, what is best for me may not be best for you."

The only problem with computers, according to Krughoff, is that they open up so many possibilities that it is easy to let your enthusiasm run away with you. The center's data base for a new publication called *Bargains* includes descriptions of more than 1,000 popular big-ticket consumer products and tabulations of dealer prices in Washington and San Francisco. Now under consideration is a telephone interface that would allow consumers to call in and browse.

"Right now, we're just playing with the idea," Krughoff says. "Providing interactive access seems to make sense, but we just aren't sure yet whether it is something consumers would be willing to support."

Software is not keeping up with hardware

BY GENE WHITE
Chairman, Amdahl Corp.

Obviously the single biggest impact of computers on society is the improvement of productivity and the benefits we obtain in quality of life. Things are being made a lot easier for us to do, whether it be shopping or running a business. It doesn't matter what the application might be; the end objective is for everyone to be able to do more and do it more efficiently.

These applications are being driven by a tremendous increase in computing power. The question is, How much more capability do we have to absorb the current impact that computers have in the world?

Our current shortcoming in the industry is the lack of talented and qualified personnel who can take advantage of the power being made available to them.

In addition, with the advent of more sophisticated communications capability, we're making the world a much smaller place. Using this capability combined with computers, we can provide services to people that are far away from the source of the transaction.

The application loads we are seeing today are continuing to grow at a pace that is substantially greater than in the late 1960s and early '70s. I don't see any slowdown of that pace in terms of creativity in the marketplace.

In the early and mid-1970s, with the advent of distributed processing, there was a theory that more of the capability would be put on-line or remote to wherever the user was. The fact is that with the cost of communications going down, it's very easy to delegate tasking to a subservient location from a large mainframe. But the need for a central control point and the management of a large data base will continue to require a large mainframe.

That need has continued to grow as companies implement distributed processing. They need more control, and they need to massage and manage and manipulate more data. The economics are in favor of having the appropriate combination of distributed processing in conjunction with the large mainframes.

The extent to which we have improved the performance of computers through technology, although generally expected, has exceeded any of the expectations I had while at General Electric Co. GE's unique business anticipated distributed processing somewhat. The company was also instrumental in starting time-sharing.

Back then, we saw that form of application coming into the world and creating change in the industry. If anything, the invention of the microprocessor accelerated getting the intelligence out there in remote locations, and that certainly happened a lot faster than we hoped for back in the late '60s.

The crisis we will face in the industry in the next 10 years is not hardware, it is software. We can see great advances coming in the hardware world, and now what we need is a lot more efficient software that takes advantage of this hardware and makes that capability a lot more flexible in terms of how it is employed.

The industry in general has lived with operating systems and systems software that have not seen the same rate of improvement in efficiency and capability that hardware has seen. We all recognize that we must evolve from a systems software position to something that is a lot more efficient and productive.

COMMENT

The Department of Commerce is a strong supporter of the U.S. computer industry and a user of its products. We have worked closely with companies and trade associations to address unfair trade practices that the industry faces in foreign markets. We have assisted in expanding the industry's presence in these markets through overseas trade missions and exhibitions.

From its commercial beginnings more than 35 years ago, the computer industry has become a major contributor to U.S. economic growth and trade. In 1986 alone, its hardware and software production reached $75 billion, and employment surpassed a half million people. U.S. computer exports were roughly $14 billion.

Within the U.S. economy, the federal government is the single largest customer of the computer industry. Within the Commerce Department alone, we have made major investments to computerize our work.

Computers range from supercomputers, used in detailed forecasting by the National Weather Service, to microcomputers for secretarial work. New computer uses constantly emerge. For example, in the past year, the method for tabulating our employee time cards has been converted from a manual exercise to a computerized program. As a result, clerical efficiency has improved, and our staff has more time for other projects.

Paralleling the revolution in the rest of the economy, the use of micros has spread throughout the department. Personnel and property administration, economic analysis, high-volume mailings, forms automation and preparation and processing of international telex messages are a few examples.

Economists, trade analysts and secretaries all have access to microcomputers, enabling them to reduce production bottlenecks and increase their productivity. Microcomputers have allowed the department to reduce its clerical staff and free up production staff time for higher level professional work, improving the quality and amount of analysis.

Our experiences in the Department of Commerce help illustrate that the federal government is in step with other sectors in computerization. We have improved user acceptance of computers in the work environment and are implementing strong support programs.

I am confident that, as we move forward into the 21st century, the department will keep pace with new technology and use the latest advances to meet future challenges.

MALCOLM BALDRIGE
Secretary of the U.S. Department of Commerce

"*Today's information technology — from computers to cable television — did not bring about the new information society. It was already well under way by the late 1950s. Today's sophisticated technology only hastens our plunge into the information society that is already here. The problem is that our thinking, our attitudes and consequently our decision making have not caught up with the reality of things. . . . The level of change involved is so fundamental yet so subtle that we tend not to see it, or if we see it, we dismiss it as overly simplistic, and then we ignore it.*"

JOHN NAISBITT
from *Megatrends*

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A FEW GOOD NAMES THAT

Information as a means to freedom

BY GERALD PROBST
Former chairman, Sperry Corp.

If the history of electronic computers so far is any clue, the next 14 years are going to produce results that even the great scientists and engineers today may not imagine.

Look at how far we have come since 1972.

■ The U.S. computer industry generated $21 billion in hardware and software revenue that year. This year it will be four times that number — and we are calling it a soft year.

■ In 1972, we were just beginning to develop fourth-generation machines, thanks to large-scale integration. Today we are well into the fifth generation with very large-scale and very high-speed integration. We are applying knowledge-based systems, using both accumulated expertise and artificial intelligence.

■ In 1972, the first CRT word processor had just been introduced.

Personal computers were costly, specialized devices in the hands of researchers. Today, both are as common, as inexpensive and about as easy to use as a television set. Millions of American homes have them.

In business, they are as common as the typewriter, which they have mainly replaced, along with the adding machine.

And today, children are using them and learning from them. I think that fact says more than anything else about computing in the 21st century. They are the ones who will do it.

■ Electronic information systems are the new core industry, in much the same way steel was in the 19th century. But unlike steel, there are no substitutes for information. It is a self-renewing resource that creates new demand. But the computer is more than just a new growth industry: It is the key to our future economic and social development.

Creating the future

I predict that by the 21st century, we are all going to be surprised by our industry in spite of ourselves. The reason is that we are inventing, developing and applying new technology at exponential rates. We are creating the future, not waiting for it.

This change is creating shock waves that are cracking the foundations of things the way they are. It is the enemy of the obsolete, of entrenched ways of doing things. It is the enemy of the status quo. It is occurring in the social, political and economic realms as well as in science. For the most part, that's good.

But we also have to recognize that the size and scope of this transformation is creating situations that a lot of the world's leaders see as threatening.

Many of them identify the status quo with stability. Many of them value stability more than progress. They react often irrationally and unpredictably. That means that we face unpredictable variables in applying tomorrow's technology today.

Since we are the ones who let the computer genie out of the bottle, we bear an extra burden in helping the world around us to understand and to cope rationally with the effects of the transformation. It has become a cliche, for instance, to say that the computer is transforming America. But it's true.

In fact, I take that statement a lot further. I say the computer is transforming the world.

Consider the world's money system, which is a function of electronics. Of course, greenbacks are still with us. But only a tiny fraction of our total is in the form we like to get our hands on.

The rest is in electronic memory or in accounts linked to a memory. But the world of money is, of course, a lot larger than our individual accounts.

Walter Wriston, former chairman of Citicorp, says that capital movements in the international financial markets "in a single day dwarf the total resources of all the central banks in the world."

The New York clearinghouse system alone handles a volume of some $300 billion each day. International trade amounts to nearly $2 trillion a year. Worldwide capital movements in a year are some 50 times greater than that — and growing.

Today money is, first and foremost, electronic information. Information is the new capital. It is multiplying the effect of the conventional capital we know in the form of plants and equipment.

The worldwide economy — especially our free world economy — depends *absolutely* on the computer. It is internationalizing the world economy in ways that treaties and accords have never managed.

The meaning of this effect is not lost on national governments, including ours. They are beginning to

realize that the tides of electronic money are passing out of the control of any single nation.

This situation concerns all of them and worries some of them.

But worried or not, they are well aware that we have reached the point at which restricting electronic money movements would be like pulling the plug on their economic life support system.

Even now there are movements afoot in some countries designed to regulate or to tax or otherwise restrict the international flow of information. We cannot let that happen.

The electronic money system, as just one example, is creating an international economic freedom we have never had before.

In fact, I would go so far as to say that for the rest of this century and the next, the concepts of international exchange of information and freedom are intertwined.

In that context, the computer is a tool for freedom and all that freedom implies. To Americans, that may seem obvious. We take both freedom and information for granted. Lots of us take computers for granted. But that is not true everywhere.

The international flow of information is essentially a freedom of the Western industrialized nations

As the electronic world of money illustrates, openness works. Conversely, closed societies are the victims of their own restrictions. Instead of applying tomorrow's technology today, they apply yesterday's ideology.

and Japan. There are two basic reasons: The first, of course, is that we are creating the technology. But the second is that we are open societies.

We hear the pros and cons of protectionism and so on. But I would say that there is one common denominator of open societies.

It is the general ability to access, exchange and process information without undue interference. This openness is fundamental to applying tomorrow's technology today.

From now on, our country and others that want to prosper must recognize that self-sufficiency is not compatible with a modern industrial state, no matter how much we admire the ideal.

As the electronic world of money illustrates, openness works. Conversely, closed societies are the victims of their own restrictions. Instead of applying tomorrow's technology today, they apply yesterday's ideology.

And, of course, they are failing. They are swimming against the tide of the future and fighting the age of information.

Today's world is pretty much divided between open and closed nations. The common denominator of closed societies is the opposite of ours.

To them, information is secret. It is a form of power that has to be controlled. The exchange of information — electronic or otherwise — is sharply restricted.

So the question is, What does the application of tomorrow's technology today mean to relations between the open and closed societies? I believe the answer is apparent. A closed society — the Soviet Union, for example — is caught on the horns of a classic dilemma.

If the Soviet Union continues to stifle the exchange of information, its economy will fall farther and farther behind. On the other hand, if the Soviet leaders open their society, they will transform it by trading control for freedom. They will become more like us.

The Soviet Union does good basic research in many fields, including mathematics and information sciences. But the basic work tends to get lost in a maze of bureaucracy that is characteristic of their closed, controlled system.

Open up or fade away

As the age of information evolves, those realities will become more and more apparent. The Soviet Union and other closed systems will open up — or they will fade away.

The People's Republic of China is an example of a closed society moving slowly toward openness. Obviously, the Chinese have a long way to go. But as they harvest the fruits of openness, they will want to do more to move our way.

None of the analyses I have seen are optimistic that the Soviet leaders want to trade control for openness. But they know better than we that their economy is a disaster and that their prospects are dim. They want to share the benefits of the age of information.

They are taking some small steps. For example, they are now allowing companies, universities and others outside the Eastern Bloc controlled access to millions of files stored in Soviet data bases. It is a small step, but in the right direction.

For them, it is a radical move, a dangerous experiment. Let's hope that they see the light and join the rest of us in applying tomorrow's technology today.

If they do, then all of us who helped pioneer the computer revolution can take pride in the fact that we contributed in a major way to world peace.

Banners waving o'er the industry battlefield

Lessons of deployment and mobility apply to competition in the technological theatre

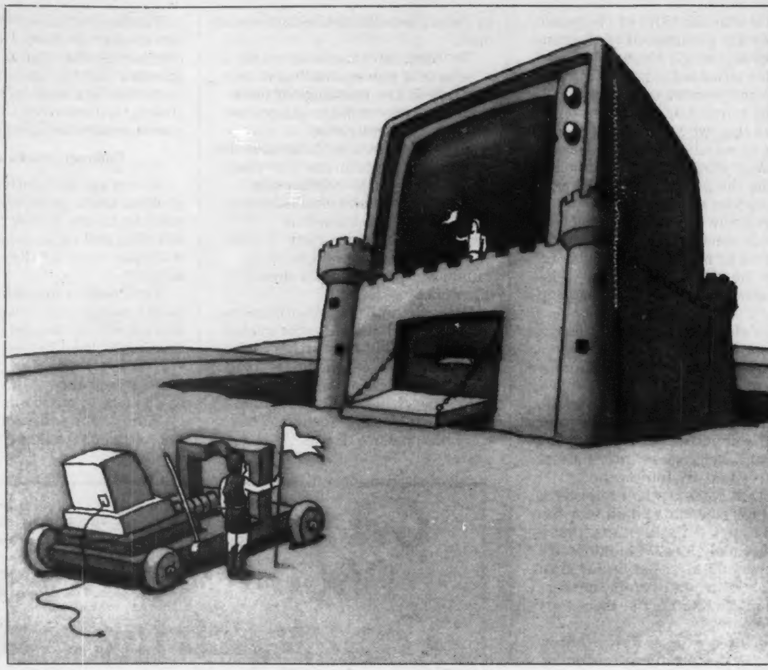

ILLUSTRATION BY ROB SAUNDERS

BY ASHLEY GRAYSON

When a business sector enters a period of intense competition, the journalists and commentators liken it to a battlefield. The computer industry is currently undergoing such stress, so let's see how remarkably closely it parallels the history of military adventures.

Lesson No. 1: There are no such things as military secrets. Once deployed, virtually any technology can be reproduced by the other side. From the short-handled pike to the machine gun, no nation has been able to control a technology for long.

In general, once a technology becomes worth studying, anyone with sufficient funding and commitment can discover any set of facts and relationships within it. Similarly, no one firm has been able to develop and hold a technological advantage over any other during the history of the computer industry.

In fact, uniqueness brings equipment incompatibility — of less value in battle than mobility and adaptability. During World War II, for example, American commanders learned to their dismay that the German guns could chamber and fire ammunition captured from us but not vice versa.

Lesson No. 2: Once a fundamental breakthrough has been made, its value will be overlooked by some who might benefit by controlling it. Famous observations include the British admiralty's comment on the submarine: "Of what value is a ship that sinks?"

Let us see how the programmable calculator became the personal computer.

Like the gunpowder-fueled skyrockets of ancient China, the computer developed in full view of everyone. Early computers, like fireworks, were considered of limited use by their makers. Despite predictions from IBM management that the world market for computers was small, the device was as quick to catch on as gunpowder.

When computers graduated from the laboratory to commercially viable products, the industry entered a period of discovery. Like the great nations of old launching expeditions to the new world, the electronic superpowers began carving out spheres of influence to settle and exploit. IBM selected the business arena, while Burroughs Corp. pursued banking, and Honeywell, Inc. and what was then Univac shared local and national government accounts.

When the Nuclear Test Ban Treaty terminated test explosions of atomic devices, Control Data Corp.'s business increased dramatically as scientific laboratories hurried to simulate the reactions they could no longer detonate. One of the biggest unheralded benefits of the computer is the distraction it has provided for the bomb makers.

This was a hectic period of free-for-all expansion in which each vendor strove for a unique identity through its hardware and software design. Competition existed but was less motivating than the excitement of growth within each player company's sphere.

No one worried much about compatibility because a customer, once committed to a vendor, faced a very high cost to convert to another manufacturer. National flags (corporate logos), languages (data formats) and, in the case of the IBM songbook, anthems solidified.

Large corporate customers became colonies of the computer powers. Their leaders were educated in the vendor's management schools and returned to establish the mother company's traditions within their own culture.

Once the superpowers had spread far enough that their spheres of influence overlapped, the industry entered a period of consolidation. With all the apparent opportunities identified, further expansion depended on encroaching on another's territory. The stress of bumping into each other brought about a very formal economic battlefield. The electronic superpowers maneuvered for market position by fielding large sales, support and service organizations.

The most stylized engagement of forces was the formal benchmark. In this exercise, which resembled an anachronistic medieval joust, all comers were challenged to beat the local champion — the installed vendor.

The test usually boiled down to determining which combination of new technology, innovative architecture and clever techniques was best at executing applications designed five or 10 years previously.

On rare occasions when territory fell to a new flag, the transfer of power was implemented by an army of occupation called the conversion team. Frequently outnumbering the data center staff by three or four to one, this division was garrisoned to speed the acceptance of the new order. During this turmoil, several great houses fell from competitive pressure and internal confusion. General Electric Co.'s Computer Division collapsed and was absorbed by Honeywell. RCA Corp. ceded its interests to Univac, which gradually integrated them. A most critical lesson was learned: "Rule one in the book of computer war: Never march on IBM."

The realization of the true costs and resource drains required by massive conversions was sobering. Talented people could be better utilized than in forcing one computer to do an application already being done by another. Under the additional pressure from the customers for free trading of information, the superpowers looked toward compatibility. More diplomatic methods were pursued to achieve the nationalistic goals of domination. But nobody noticed the innovators.

In the late 1960s, Digital Equipment Corp. discovered the minicomputer. This technological breakthrough, unappreciated at first by the superpowers, heralded a major shift in computing and computer culture. A spirit of nationalism arose among the users.

Unable to implement new applications at data centers burdened with existing administration, commercial entrepreneurs and universities turned to the smaller, more accessible systems. Local self-esteem got a boost from these minis that it could never acquire at government house, whereas the data processing center staff existed to serve the mainframe computer, the minicomputer arrived to serve the people.

Convinced that they had seen a better vision of the future, guerrilla leaders smuggled minis into their territories and quickly gained the confidence of the local users.

Within a few years, minicomputer acquisition became a regular activity of all large companies. In addition, an entirely new customer base arose from smaller corporations.

Seeing these opportunities, start-up companies appeared to provide equipment to the

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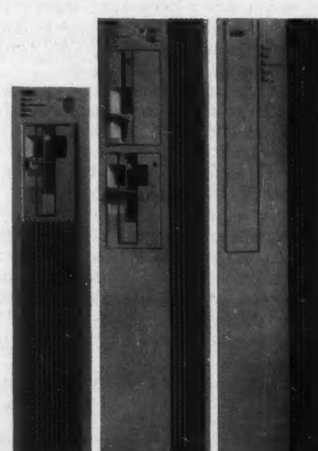

rebels, among them Prime Computer, Inc., Tandem Computers, Inc. and Data General Corp., itself a secessionist group from within DEC.

During the growth of the mini makers into powerful and stable players, many of the same scenarios of the previous period were replayed on smaller scales. However, there were some important differences: Where the superpowers granted solutions to the customer base, the mini makers offered only tools. The computer battlefield changed from a chessboard of grand strategy to an island-hopping revolution.

The fast turnover of goods and services enabled the mini makers to be much more effective than the superpowers. Having lost the initiative to the upstarts, the superpowers attempted to acquire a portion of the new market through acquisition and imported goods.

Although all of the major mainframe companies eventually integrated minicomputers into their culture, none became the forces that DEC, Hewlett-Packard Co. and Data General did. Some subtle spark seemed to be missing. No company developed architectures as significant and enduring as the PDP-11, HP 3000 or Nova.

Although each sale was for smaller stakes, there were more sales opportunities, and it was possible to learn by doing with less at risk if the staff blundered. So the mini makers built great empires among the superpowers.

But nobody noticed the innovators. In the late 1970s, Apple Computer, Inc. discovered the microcomputer.

With the introduction of the personal microcomputer, the battle began again for local turf — the gang wars. The pride of territory found in the Apple and Epson America, Inc. QX10 series owners is deep and enduring. All but one of the powers with the most expertise and resources to develop the new opportunity ignored it.

Mini-power DEC, which pioneered the low-cost personal mini, totally miscalculated the micro. DEC's appeal had been open architecture, low cost, accessible minicomputer products. In the micro wars, the company fielded an overengineered, excessively expensive system bound up in red tape. Other makers of minis and mainframes did no better.

The single exception among the established vendors was ultra superpower IBM. The design of the IBM Personal Computer was expandable, accessible and positioned so that many smaller companies could improve on it and fill niches around it. IBM released not so much a product as a standard.

By introducing a universal measure, IBM was able to direct areas of endeavor that it could never hope to control. Few resources can now be obtained to develop something better when so much can be gained by being compatible. The single holdout has been Apple, but it is unclear if it will resist compatibility for much longer.

The benefits brought to the individual citizen by such an economic superstructure are substantial. Chief among them is a stable environment for investment. All vendors of compatible equipment can compete freely if the consumers are confident their investments in data, programs and training will be transferable should their current vehicle fail.

With the economics of uniformity has come a shift in philosophical outlook to one of the joys of conformity. In a development unseen since the church of the Middle Ages, IBM PC compatibility has united diverse political, geographic and economic interests in a universal brotherhood.

Thus, in each period we've examined to date, the goal of the powers was to establish a base from which to develop further their vision of a cohesive and enduring culture. This is no longer the case. The Pax PC has unified our world view. Mighty powers continue to plan, but actions will await word from the Holy See — IBM.

Dissident factions that once applied their energies to creating better methods cannot attract capital to finance diversity.

However, computer technology, like weapons technology, has become so available that anyone can assemble a machine profitably if only compatibility and price are required. Today, any band of loonies with modern arms can hold up an airport for several days. Likewise, anyone with an overseas source of components can hold a portion of the computer market for a period of months.

However, they have no viable culture to replace the one they attack, and their aim is exploiting pricing vacuums for short-term profits.

Where is all this leading? One trend is clear: More and more computing power is being placed in the hands of the individual. But at the same time, are the thoughts that are thinkable becoming fewer? Yes and no.

Fewer firms are designing "the best user interface," but more companies are offering improved interfaces for the IBM PC running Microsoft Corp.'s MS-DOS. Fewer different machines are seeking basic communications with each other, but more diverse telecommunications programs, protocols and line speeds are available.

But all this may change tomorrow.

Grayson is the founder of ADG in San Pedro, Calif., a company specializing in developing documentation and marketing materials for high-technology firms.

Tools & keys: Unlocking information via networks

By JAMES THORNTON
Chairman, Network Systems Corp.

When I started designing computers 36 years ago, they often were referred to as electronic brains. Today, there is accelerating activity in artificial intelligence, so it makes you wonder just how far we have come.

In reality, we have come a very long way, and it is impossible to conceive of modern business, science and engineering without computer equipment.

As remarkable as the advances of the past four decades have been, however, I am convinced that we have only scratched the surface, that quantum leaps in technology are still ahead. One of the keys to unlocking this future potential is communications, a field with which I have been closely involved for the past 15 years.

Many of the computer industry's current woes are blamed on the lack of adequate communications or the inability of different computers to share raw data or finished results. But the notion that all our troubles would be solved if computers could just "talk" to one another is overly simplistic and misses the point.

The challenge of data communications is not merely in solving the problems of data transfer but in realizing the opportunities made possible by true peer-to-peer communications.

Significant progress has been made toward this goal, but we still have a long way to go. It wasn't overnight that we went from Bell's call to Watson to a worldwide network accessible from a single telephone. Neither will global data networking come about without time and trial.

Shuffling data between personal computers or from mainframes to terminals is essential in many businesses. But the major opportunities lie in allowing computers of any type and in any location to exchange finished results — in effect, to add value as part of an ongoing process.

We have seen a strong trend in recent years toward specialization in computer equipment — systems for applications such as computer-aided design and manufacturing, manufacturing, transaction processing, word processing and medicine.

This specialization has in many cases also led to balkanization, with department-level computer centers operating in isolation from each other and from the main data processing center.

Now that we have these powerful and beneficial specialized systems, we need to concentrate on linking these distributed computer centers into a cohesive whole. Simply stated, the next wave of technological innovation must be to network the networks.

Semantics is rarely a feature of computer industry talk, but in this case we need to draw a distinction between information and communication. Our society is awash in information. Corporate data bases are measured in terabytes, and many scientific problems require hours of effort by computers working at close to a billion operations per second. We are generating so much information that we are outstripping the capacity of tape and disks, and we can't wait for optical recording.

Our society is awash in information. But what good is all this information if it is not communicated — if it is not transmitted from one person to another in a useful form?

But what good is all this information if it is not communicated — if it is not transmitted from one person to another in a useful form?

The effects of computers on us are many. They help save time and money, improve quality, bring hope to the ill and make possible space flight and advanced national defenses. They change the way we think about issues, and they attack problems.

But computers were intended to be, and remain, simply a tool. And a tool is useful only when it is employed toward a beneficial end. In our case, that means when information is communicated.

My hope — indeed, my prediction — for the next 40 years is that this industry will creatively and effectively merge its outstanding ability to generate data with its growing capacity to achieve true communication, so that data communication will not just be one facet of this industry but will be the foundation for another four decades of innovation and strong growth.

PC hardware and software industries face future shock

Brand names will lose meaning as component standardization rules

Adam Osborne, at home as a PC software publisher.

BY ADAM OSBORNE
President, Paperback Software International, Inc.

What now? Certainly the microcomputer industry is maturing in that the hardware industry is now dominated by large and well-established companies. But hardware is only part of the story, and even here, changes are not everything they seem to be.

Standardization is and will remain the economic driving force in every segment of the microcomputer industry. Nowhere has this become more evident than in hardware, where IBM established a standard from which even it can no longer deviate.

And yet, IBM is losing out within the very market the company created for its own Personal Computer. Every part of an IBM PC is now manufactured inexpensively and in a vast quantity from a variety of sources.

Rather than see the microcomputer hardware market consolidate into a few major players, therefore, you are more likely to see every system's house and computer storefront selling its own brand. No one will care what the label on the front of the machine says, knowing full well that the boxes are filled with standard parts anyway.

Within the IBM-compatible market, therefore, domestic manufacturers can survive only by remaining on the cutting edge of innovation, being the first to offer each new advance in CPU performance and disk capacity.

For manufacturers that are not in the IBM-compatible market, the future must be bleak. They do not have the economic advantage of massive component manufacturer competition, so that prices will inevitably be higher. Slowly and inexorably, their niche markets will be taken over by IBM compatibles.

Education market

Even the education market, the redoubt of Apple Computer Corp., will ultimately fall to IBM compatibles. After all, what school would want to teach its pupils using computers that they will never see in the workplace?

The microcomputer software marketplace is probably five to eight years behind the hardware marketplace in terms of maturity. The final cost of characters is by no means in place yet, although some predictions can be made based on standardization and company profiles.

The operation system standard has clearly been defined around Microsoft Corp.'s MS-DOS and the necessary future evolutions of this operating system, which, incidentally, is already quite inadequate. The spreadsheet standard has been set by Lotus Development Corp.'s 1-2-3, but no clear standard has yet emerged in any other part of the software industry. It will come.

The market will also shift from a few bread-and-butter business applications dominating sales to a more broad-based environment where hundreds or thousands of more specialized programs sell in smaller numbers to smaller market segments, while maintaining data base compatibility one with another at some underlying level.

To be economical, the software manufacturing model must shift more towards the book publishers' model, which relies on outside authors to generate the product that is ultimately published and sold by the software company. The economics favoring outside authors is simply too overwhelming to be ignored.

By relying on outside authors, software companies do not have to foot the bill for development projects that produce no product. They also pay the authors royalties from cash received, which certainly beats funding a project for a year or two before the first sale can be made.

Outside programmers

The counter argument — that an outside team of programmers cannot be controlled with an inside team on the payroll — is, of course, nonsense. A successful outside team of programmers (and they are the only ones of any concern to a software publisher) are working for themselves and are far more likely to remain as a team than in-house programmers who can, at any time, up and quit. Moreover, the best programmers work for themselves.

In the future, therefore, software companies will come to resemble publishing companies more and more and, like publishing companies, will never be dominated by any giant. It is simply too easy to compete with any successful product, as Lotus is in the process of discovering.

I seriously doubt the largest software company will, in the future, be able to hold more than 5% of the market. It is probable that about 20 leading companies will emerge, jockey among themselves for market share with perhaps 200 companies in the second rank and 2,000 in the third.

Excluding my own company from consideration (for obvious reasons), I would say that the strongest software companies today are Microsoft and Borland International. These are the two firms possessing the diversification and structure most likely to propel them into the forefront in the future. Lotus and Ashton-Tate are too highly dependent on individual products that are vulnerable to competition.

By the end of the next decade, the computer will be an integral part of everyone's life. It already is for most people in the workplace.

But among the major innovations in the coming decade, I expect to see a new class of leisure-time products that take full advantage of the computer's capabilities to generate whole new markets. What will these products be? I wish I knew.

How new technologies change business

BY RON SCHNEIDERMAN

The computer industry is one of the most closely studied business sectors in history.

Familiar are the market research reports detailing what's selling, who's selling it and, of course, how it's going to sell five years from now.

Some studies are quite ambitious, such as "Automation of America's Offices — 1985-2000" or "Managing End-User Computers in the Federal Government."

Others can generate as much emotion as they do information, such as the report released by 9 to 5, the National Association of Working Women, showing that finger strokes, anxiety levels, bathroom breaks and general productivity of workers at video display terminals are increasingly being monitored by computers.

On-screen jokes to relieve stress don't make up for flashing messages telling employees, "You're not working as fast as the worker next to you." Such techniques, according to 9 to 5, invade privacy.

Some studies tend toward the esoteric. "Ethical Implications of Computer Networking in Science and Government," sponsored by the National Science Foundation under a $150,000 grant, is currently being honed into publishable form by six faculty members of Stevens Institute of Technology in Hoboken, N.J.

Investigating conflicts

The Stevens team includes a philosopher, a political scientist, two computer scientists, a physical chemist and a physicist. Since early 1985, the group has investigated the conflicts of values created by computer networks, such as privacy vs. the demand for social cooperation and ownership vs. accessibility.

For one thing, they believe that the practice and style of science could be totally different from what it is today in a completely networked computer environment. I. Richard Lapidus, a physics professor and study team member, says a scientist will achieve immediate access to everyone in his particular field. "Furthermore, the use of remote-controlled, computer-directed instrumentation will eliminate much of the need for physical presence by the scientist. As a result, there will be considerably more collaboration between scientists at distant locations."

Question of ownership

But who will own the data? According to Lapidus, there have been remarkably few legal disputes over this issue in the past. "In a networked environment, where investigators may be required to make their raw data available to other scientists, such disputes will become commonplace, and a set of rules will have to be developed to resolve them."

Lapidus says that even if technology advances no faster in the next 20 to 30 years than it has over the past 20 to 30, "the actual networked computer environment in which the practice of science will take place may be beyond the most outrageous speculations we make today."

Yet another study, this one on business, is a planned five-year, $5 million effort by MIT's Sloan School of Management.

Called "Management in the 1990s," the project is studying the effects of computers and telecommunications on managerial practices, how information technologies affect communication patterns among workers and organizational structures and business strategies. Some of the issues to be examined are still evolving.

The study is being funded by nine corporations, including Digital Equipment Corp., American Express Co., Arthur Young, Bell South Corp., General Motors Corp., Eastman Kodak Co., MCI Communications Corp., International Computers Ltd. and British Petroleum, as well as the Internal Revenue Service.

Project goals

The MIT project hopes to explain how rapidly growing technologies change large business structures and strategies as they are growing.

"The fact that technology will continue to change over the five-year period of the study shouldn't have much impact on technology-oriented managers who are used to adapting to changes in the technology," says Roger Samuel, program manager of the MIT study. "At some point, there will have to be a change in the mentality of [nontechnical] managers who will have to think more like the technologist."

Since the program got under way about a year ago, the sponsors have developed some ideas about information technology in the future — their expectations and possible implications. These have been collected into the "Sponsors' Future Vision," essentially a set of working papers that have become a discussion vehicle for MIT's Sloan School faculty.

A sampling of predic-

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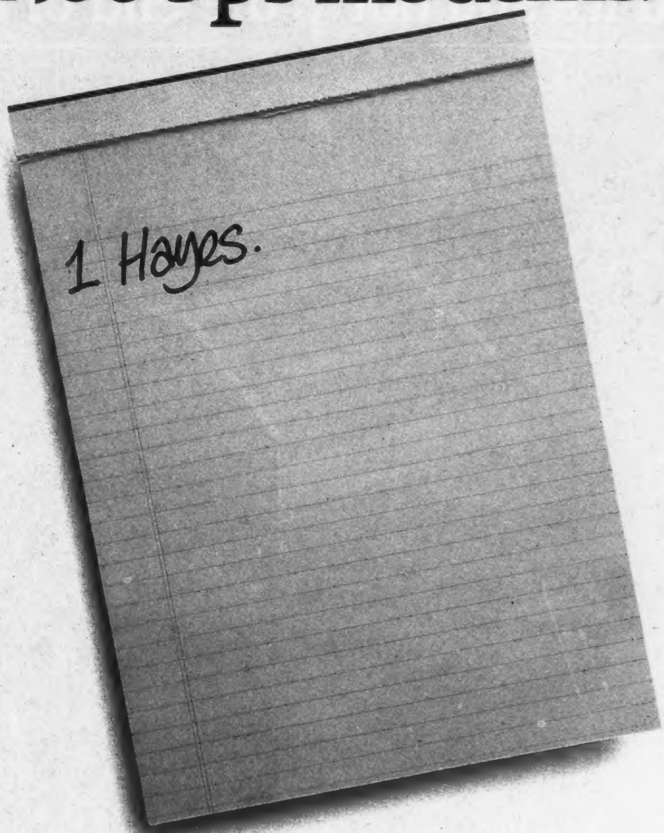

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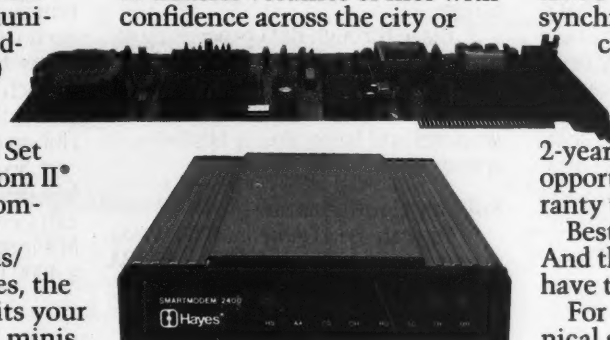

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tions from those papers:

■ As a profession, information systems will rise to a peak before 1990 and will gradually decline as managers and individuals in other functions increase their information technology managerial skills.

■ Work at home will become a reality for one-quarter of the population of postindustrial societies by 1995.

■ The proportion of individuals using information technology in the course of their daily work will rise from 25% in 1985 to more than 75% in 1995 in Western and advanced Asian societies.

■ Large organizations will either develop a culture that encourages information technology innovation or will be forced to acquire, collaborate with or be acquired by others.

■ General business managers will be expected to attain proficiency in information technology by the year 1990.

Another expectation, or vision, is that end-user perception will shift from systems reflecting the skill of a few individuals being used by many to the experience of many being available to a few.

"Where information technology will differ from traditional MIS," at least one sponsor says he believes, "is that no presumptions will be made about the scope of the decisions, whereas MIS systems tend to imply some boundary of the scope of the information available."

Moreover, the researchers believe that industries will weave an electronic web that integrates the information flow of multiple organizations, accelerating the flow and eliminating, or sharply reducing, the amount of redundant information.

Congress is conducting studies on everything from pregnancy risks among video display terminal users to the effectiveness of computer security within government agencies.

They expect that auditors and controllers will be slow to respond to the risks and exposures provided by the newly integrated information flows.

They anticipate standards for electronic documents will be adopted for most industries by 1990 and fully implemented by 1995. The electronic equivalent of a signature will be generally available and integrated into services by 1995.

One of the implications of these ideas floating back and forth between sponsors and researchers at MIT is that electronic integration of industries will, to a larger extent, replace acquisition as the mode of creating vertical organizations that process raw material for sales of finished goods in either real products or services.

Other research projects examine different aspects of the computer age.

■ The Brookings Institute is studying investments in high-technology markets, such as robotics.

■ The University of California's Public Policy Research Organization in Irvine is exploring how

people will use computers in the future.

■ Dunn & Bradstreet Corp. is trying to define information and determine its value.

Still, no one can top the federal government when it comes to information technology research.

The government studies support the growing mass of information technology legislation. Between 1977, or the start of the 95th Congress, and 1984, the end of the 98th, more than 230 laws related to information policy were passed, most dealing with information systems (92) and disclosure or piracy (71).

More bills passed

In fact, the pace quickens with each session of Congress. Of the 400 laws passed by the 98th Congress, 58 were information technology related.

The Office of Technology Assessment (OTA), an arm of Congress, has been one of the busiest, conducting studies on everything from pregnancy risks among VDT users to the effectiveness of computer security within government agencies. The latter is poor, according to the OTA.

More recently, the OTA, in anticipation of legislative proposals on advances in data bases, published "Electronic Record Systems and Individual Privacy."

OTA also started work on a study called "Technology, Public Policy and the Changing Nature of Federal Information Dissemination," an effort to document what technology means in terms of the government's potential to provide information to the public and the possible impact of going from paper to electronic communications. Another new OTA project is a two-year study on telecommunications.

A close follower of all this activity is John R. B. Clement, director of governmental activities at the American Federation of Information Processing Societies (AFIPS) in Reston, Va., who is conducting a number of studies for AFIPS, including an effort to determine where information policy is located in the federal government.

Congressional committees

This is no small task. Clement notes, for example, that 10 committees and 17 subcommittees of the U.S. Senate and 13 committees and 30 subcommittees in the U.S. House of Representatives share some significant jurisdiction or legislative role in information policy matters.

Clement's wish list includes funding to conduct a study on the privatization of government information systems — that is, moving government-run services to private industry.

This increasingly important issue concerns not only Clement but government employees who are particularly interested in communications and information technology.

Privatization

"The government has already said it would like comments on privatization of the National Technical Information Service, which disseminates such things as census tapes, requests for proposals for government contracts and so on," Clement says.

"There is a potential problem because none of this information is copyrightable. How do we prevent giving someone in the private sector a potential monopoly on information?"

According to Rep. Gary L. Ackerman (D-N.Y.), chairman of the Subcommittee on Human Resources and the Post Office and Civil Service Committee, the administration is prodding agencies to review more functions for possible contracts.

Commercial activities

He says the Office of Management and Budget, which reports to the White House, plans to target certain commercial activities, including data processing, for direct conversion to commercial contracts without any in-house competition or cost study.

This "hiving off" of the government's activities, as it's called, is a hot issue expected to come under closer scrutiny in coming months.

And that probably means more studies.

Schneiderman, who is based in Bedminster, N.J., has been covering the computer and electronics industries as a reporter and editor for more than 20 years.

The evolution of automation and work

The information age impact on American workers and offices

Harley Shaiken is professor of communications at the University of California in San Diego. He researches issues in information technology and the workplace. Computerworld *senior writer Michael Sullivan-Trainor interviewed Shaiken on the impact of computer technology on American workers.*

What are the major effects of computer technology on the work force?

SHAIKEN: There are two broad impacts. One is a reduction in the number of jobs, and the other is the quality of the jobs that remain. If automation is successful, it raises productivity, and that generally means that the same number of people or fewer can produce more.

The other question is the quality of jobs that remain. How does automation affect the skills that are required and the way the work is organized? There the technology offers a lot of possibilities. It offers options that increase skills and responsibilities, and it offers alternatives that do just the opposite. What we've seen in many cases is automation introduced in a way that reduces skill and requires less responsibility, which often leads to less satisfying and more controlled jobs.

Do you have any statistical evidence of these trends, such as number of workers displaced?

SHAIKEN: The relationship of automation to displacement and the economy as a whole is complicated because there are factors other than technology. There's the state of the economy, international trade, the health of a given industry. Despite all those other factors, automation clearly has an impact.

In the automobile industry, for example, peak employment was reached in 1978. In 1985, there were several hundred thousand fewer workers in the industry producing roughly the same number of cars. Now, other things beside automation took place in that time frame. But one of the critical factors that resulted in that productivity increase and fewer jobs involved was the fact that a great deal of highly automated technology was introduced.

Is business taking some responsibility for retraining the people who are displaced by automation?

SHAIKEN: It's happening to a much smaller extent than the nature of the problem involved. But the issue goes beyond what any single corporation or any single industry could do. This really calls for broader national policies to address the issue of training and retraining and also address the issue of generating new employment.

What would be an example of such a policy?

SHAIKEN: Let's look at the issue of training and retraining. There's billions of dollars worth of training that goes on within any given industry for workers who remain at a company, but if we look at what happens to displaced workers, training becomes far less effective.

There were more than 11.5 million people displaced between 1979 and 1984. About half of them wound up in other jobs relatively quickly, but a large proportion of them were unemployed for a great deal of time, and many left the work force entirely. Under those circumstances, all the retraining that was available consisted of short courses under the Job Training Partnership Act.

The way training is carried out in other major Western industrial countries — West Germany, for example — is much more comprehensive. There are financial aids available to a worker to have both longer training and to ease the transition into new industries or new areas.

Here training is defined very narrowly for displaced people as merely giving them certain courses and new skills. But to make the transition from a declining industry or from one that has rapidly automated into a new area requires a lot more than a 16-week course in something.

Are other countries being as strongly affected by automation as the United States?

SHAIKEN: Well, Japan, for example, has had a very important shock absorber for these sorts of things, and that is a rapidly growing export-based economy. To the extent that that changes, Japan will also face many of the problems we are facing today in the United States.

Ultimately the successful use of automation depends on the fact that workers do not feel they are going to be its victims. That is, the extent to which you think that automation really means you lose your job is the extent you're going to be opposed to technological change. Establishing a real infrastructure that can enable people to adjust to change before they become its victims is central to an effective use of automation.

COMMENT

It strikes me that computers should be employed in any area in which the information they provide can be more efficiently handled on a computer than under the old-fashioned way of doing business. This is a very broad spectrum, but it is the manner in which I would view the role computers should play in our contemporary society.

We do not use computers at home at all because we like to spend as much time away from business as possible. Our business hours are very lengthy throughout the year but particularly so during the [football] season and in the period immediately prior to and after the campaign is finished.

At work, computers handle many aspects of our operation, including scouting reports on all of the outstanding college seniors who might be eligible for the upcoming draft each year and scouting reports on professional players who have been drafted in the league and may be about to be cut. Information gained through our college scouting operation provides input for the pro scouting data bank and helps us when trades are being discussed.

On the business end, computers also handle printing, distribution and billing of season tickets for our own organization and the Boston Celtics as well. We have also done some work for Boston College, both for the games at our stadium and at the Alumni Field facility of the college.

We also use the computer for payroll and for developing information on game tendencies employed by our opponents. We set up a memory bank so that when the coaches are preparing their game plan each week, they can ask questions of the computer. For example: What is Dan Marino likely to do when it is third and long, or what might he do if he is close to the goal line when it is third down and short yardage? The coaches' questions are answered through the data base in the memory bank, which holds play-by-play information for each of our opponents' games.

I think computers have made life a little less complicated and more efficiently run. What used to take hours to assemble manually is now prepared in minutes and cannot help but lead to a more efficient operation than we ever dreamed of before computers came into our lives.

WILLIAM H. SULLIVAN JR.
President, New England Patriots

“*People often ask whether in the future children will program computers or become absorbed in preprogrammed activities. The answer must be that some children will do one, some the other, some both and some neither. But which children, and most importantly, which social classes of children, will fall into each category will be influenced by the kind of computer activities and the kind of environments created around them.*”

SEYMOUR PAPERT
from *Mindstorms*

Is computer failing man or vice versa?

BY LILLIAN LYLES

In the early 1960s, the company in which I was employed decided to upgrade its computer system from the IBM 1440 to the new wonder of the age — the IBM 360. It is hard for anyone who was not part of data processing during this period to appreciate the excitement of the company in being granted permission by IBM to own such a marvel.

As was common practice in those days, a contest was held among all of the employees to select a name worthy of this newest member of the staff. After very careful consideration, the winning entry was chosen to be "Moses" — for "he" would surely lead us out of the wilderness of red tape and into the promised land.

Apparently we haven't made it yet.

As one who has been a data processing professional for more than two decades, as both employee and consultant, I am somewhat dismayed that there is now considerable discussion of the failure of the computer industry to meet the needs or expectations of business — although the business community has invested generously in computer technology from the beginning. Certainly one should exercise caution in accepting such broad generalizations without any reservation.

Complex contributing factors

The factors contributing to this perception of data processing are many and complex. I would suggest that the major elements should be examined carefully by concerned individuals before they draw too many conclusions. In fact, according to the *Fortune* magazine article, "The Puny Payoff from Office Computers" [June 1986], while white-collar productivity, with the assistance of computers, has not increased as much as might have been desired, it is entirely possible that without them, productivity during the past 20 years might actually have decreased.

Certainly there are several instances of industries computerized to an extreme degree — and so successfully that we seldom take note of their accomplishment. The computer "revolution" has definitely affected many aspects of daily life and frequently so profoundly that we take continuous system operation for granted. Consider travel — from your family automobile's systems to the ease of completing airline reservations from anywhere in the world — home appliances, public utilities, energy control, health professions and financial transactions — from point-of-sale purchases to credit cards to Wall Street.

Even as I point out obvious industry success stories, I must admit having observed far too many frustrations and disappointments on the part of individuals attempting to automate. Certainly hardware should not be blamed. It has gotten better and less expensive and, in most cases, easier to use. Application software of every kind abounds, and even if one feels that "canned" programs are not ideal, they can usually be modified easily enough to give the desired results.

In addition, programming aids today, in the form of utilities, data base management systems and so on, permit programmers of modest ability to be very productive. Therefore, we may conclude that these less-than-happy endings may be attributed to the users themselves, DP professionals or even vendors — that is, human problems. The causes may be ignorance, obstinance, greed or fraud. It is worthwhile to illustrate these points with a few war stories.

Gross inappropriateness

There comes to mind the elected official who so desperately wished to enhance his public image that he, like so many victims, insisted on having state-of-the-art technology. His friendly hardware vendor salesman exploited his ignorance and sold him a grossly inappropriate system — at a gross price. Not only was there no suitable application software, there were practically no programmers available in his region.

Also, the system's several gigabytes of storage capacity was greatly in excess of what was necessary. As a result, the user has yet to achieve results that others now take for granted on much smaller and much less expensive computers. In this case, the user and the hardware vendor doomed the installation.

We have all observed situations in which employees go to great lengths to ensure that automation will not succeed.

I was asked to install a small computer and accounting system by an employer who was genuinely concerned about his overworked clerks, particularly the very outspoken lady who was having to spend virtually all of her time preparing payroll manually. The installation required roughly two

hours, and it was quickly demonstrated that the monthly payroll could be generated for the entire staff in 45 minutes.

Sabotaging the system

As I waited for expected expressions of gratitude, I happened to look into the face of the payroll clerk — and quickly realized I had just made an enemy. During the next few months, I observed in amazement her ruses to sabotage the system.

The final straw came when an illness on payroll day forced her immediate supervisor to get on the telephone with me and learn how to run the payroll by himself, which he did.

This had a negative effect on the clerk's career, since the supervisor decided he would rather spend an hour or so doing it himself than endure a month of complaints.

Unrealistic demands

Then there is the DP customer who makes unrealistic demands of either his DP staff or consultants and quite frequently fails to acknowledge his computer system's true importance.

One gentleman spoke bitterly about the costs and shortcomings of his system, but boasted to others that his system had saved him four times its purchase price in thwarted employee thefts during its first year of use.

Another customer who had more than 20 years of vital history and current data managed on a $5,000 microcomputer that had proven itself indispensable remained unhappy because the system wouldn't do more.

Installation compromise

The foregoing examples illustrate cases in which parties other than the DP professional were responsible for compromising, or at least attempting to compromise, an installation.

Nevertheless, the reader should not conclude that I find no fault with data processing professionals.

Regretfully, there are far too many examples of individuals in our industry who have no qualms about using their position or technical knowledge to their own advantage, even if they hurt customers, co-workers or employers. These individuals range from the night operator who illegally sells time on his employer's system while neglecting his company's work to vice-presidents who advise their company to take a course of action that results in either unnecessary spending or failure.

It is common to find companies saddled with outmoded systems that require huge expenditures for maintenance, perform poorly and generate significant customer dissatisfaction and alienation.

This result may be for no better purpose than to protect the keys to the kingdom or the manager's sense of security.

The heart of a business

DP is generally the heart of a business and can determine the financial health of a company.

I have watched several companies falter and even die because of selfish and unethical motives. Since companies are made up of people whose livelihoods depend

There are thousands of mundane, boring activities that are still being done manually and that should have been automated long ago — not to do away with jobs but to help employees be happier and more productive.

upon their continuance, I do not feel kindly toward those of our profession who see themselves in a role other than the role of service.

These members may be the executive who, while paying lip service to progress, refuses to go forward with implementation, or the operator who just somehow can't get the work done until it is too late.

Cost overruns, delayed schedules, incorrect data, poor planning and inaccurate information are hard to pinpoint.

Finally, there are thousands of mundane, boring activities that are still being done manually and that should have been automated long ago — not to do away with jobs but to help employees be happier and more productive.

With the proper DP help, far fewer small businesses would fail. The micro industry has already had an impact.

Peachtree Software, Inc., Borland International, Inc. and others have made outstanding contributions, not only with the quality of their software but by making it available at reasonable prices.

With so many people still not trusting DP or using it as they could, we have a great opportunity to help those still entangled in the red tape of record keeping, looking for Moses.

Lyles is president of Data Compression, Inc. in Chicago, an applications, engineering and consulting firm.

Software: Science, art, tangible or intangible?

BY MARTIN GOETZ
Senior Vice-President, Applied Data Research, Inc.

When I started my career as a junior programmer for Sperry Rand Corp. on election day in 1954, the Univac I processor was helping predict the elections for the first time.

My first assignment was to help build a gas and electric billing system on the Univac I for Con Edison in New York. At that time, large organizations were buying Univac Is, IBM 705s and Honeywell, Inc.'s 800s for commercial applications.

Banks, insurance and manufacturing companies and government agencies started converting their massive punched-card installations to general-purpose computers. Little was known about applications — how they should be designed and programmed, how long they might last, how expensive they would be to maintain and who would be best able to program them.

Certainly the full potential of computers in a business environment wasn't recognized. For the most part, companies viewed large-scale computers as more economical than punch cards for processing data.

Today, computer usage within commercial organizations has changed dramatically. But many people still try to categorize software, or programs, in ways that confuse commercial organizations. Controversies about software continue. Is it an art or a science, tangible or intangible, taxable or untaxable and so on. For years, hardware companies did little to clarify the issues. Until 1970 they gave software away and put it in the public domain. They talked of software, programs and programming as a service. They were wrong.

Today computer programs run companies, but their true value is often misunderstood. Some companies that recognize the critical importance of software control its use tightly. Other companies allow personal computer users and information center users who have little or no formal data processing expertise to develop applications. Some people believe programming and programmers will disappear in the future and that end users will eventually develop most of a company's applications. These end users would define and develop applications without qualifying as software engineers. By defining the requirement of an application, the computer would magically determine its detailed logic.

This may be true for small, simple applications, but not for larger and more complex ones.

Complex applications

Organizations generally build complex business applications to solve specific major functions such as accounting, finance, order processing, manufacturing, inventory control and customer information systems. These applications generally build upon existing applications that solved part of the major functions along with manual procedures that processed the other parts.

Capturing the logic of the manual procedures and thoughts of the people who process and analyze information cause applications to become more complex. As companies grow, these procedures, logic and business rules increase in complexity. In most companies, these applications still represent a combination of work being performed manually and automatically. In addition, most complex applications are related to other complex applications and to people who interact with them.

For the past 25 years, a major task in developing complex applications was to build a detailed specification from which the application could be built. A complex application embodies thousands of business rules, procedures, log-

ic, data formats, report definitions, screen formats and data transformations that must be systematically organized, tested and maintained.

One way to think of a complex business application is to treat it as a machine — as an assemblage of components that transmit information to one another in a predetermined way. Treating a business application as a machine means that it must be systematically designed, built, tested and maintained. Disciplines required for such "software machines" are similar to those for "hardware machines."

For instance, software machines should be developed by trained software engineers and systematically designed and built in modular form. Business organizations must realize that software is closer to an engineering science than to creative art and that properly developing a complex business application requires trained personnel who follow strict disciplines.

What can we expect?

The development of business applications can improve significantly with fourth-generation, higher level languages. These languages can reduce the design, development, debugging and maintenance of complex applications by 20 to 1. They also can permit the prototyping of an application and the documentation of its business rules. And they allow for improved communication between the application developers and users.

By 1990, I believe that 90% of all new complex business applications will be programmed in fourth-generation, higher level languages. These languages will evolve over the next 20 years and will incorporate artificial intelligence techniques to improve an application's reliability, ease of use and performance. Maintenance and enhancement costs will fall dramatically as these higher level languages incorporate relational data bases and data dictionaries.

While the programming process is well-known today, there is little agreement on the role of methodology software in information system planning and in analysis and design of complex applications. Many methodologies are partially automated and contribute to the systematic definition, analysis and construction of business applications. But most companies do this work in a piecemeal fashion and usually from the bottom up, rather than from the top down. In future years, new methodology software tools will help make software engineering a true science.

Plan for the future

Corporations should begin to realize that well-designed and constructed applications are critical to their survival. Corporate computing is only beginning. In the future, mainframes, minis and PCs will be networked to share data processing loads. These networked systems will form the basis for true corporatewide information systems. Local-area networks in conjunction with wideband communications systems will allow applications to be built that share processing between multiple computers and where the data can be distributed onto multiple computers. Corporations should plan to accept computers and applications as strategic weapons rather than corporate overhead. And they should plan to build these complex applications to last 20 to 30 years.

Many of today's companies have up to 30 years of experience developing complex applications. Many now recognize the extensive shortcomings of Cobol. Some have gone to higher level language program generators that are preprocessors to Cobol.

Many others, however, now use fourth-generation, higher level languages that produce object code directly. These are the languages of the future. They will improve over the years in functionality and performance. They have already proved their worth. Over time these compiling systems will produce more efficient code than that developed by Cobol-based compilers.

These trends will not only dramatically reduce the cost of programming but will produce significantly more reliable programs that require significantly less maintenance.

Hit or miss? Secrets for creating top software

BY DANIEL BRICKLIN

With all of the promising new types of software products that come out, why do some catch on and others never make it? How do you determine if a new way of doing something will supplant the old? Looking back at several products, I think I can see a trend.

Products take off only when they are so much better than what went before that buyers are *forced* to make a purchase. Success requires a productivity improvement of roughly 100 times or, measured differently, a three-week payback.

Users have a lot of inertia. Once they invest the money, time and effort to start using a particular type of product that satisfies their needs, they do not want to change. No minor improvement in productivity will justify throwing out that investment.

The cost to change is so high that software products that promise only a savings in the future are not worth pursuing.

Only a new product that justifies the switch so quickly that it would appear stupid to put off the switch will sustain the tidal wave of user acceptance that developers so eagerly seek.

Upward-compatible upgrades

An example of a type of product that usually gets quick, widespread acceptance is the upward-compatible upgrade. In this case, the cost to switch is very low, since the user usually has to make no changes. Most upgrades have features that are widely desired and are available for a nominal charge. Therefore, they are perceived to have a very good cost-benefit ratio.

With new products, you must determine the cost-benefit ratios very carefully. For example, many utility programs have been on the market, but only a few types have really caught on.

One is the "unerase" program, such as Norton's Utilities. While you may use this program very seldom, if ever, the fact that it can recover hours or days of work in minutes gives it a great cost benefit.

Another product category is the desktop manager that pops up over your work. These give you many of the benefits of having a second computer on your desk tightly coupled to your current machine. At a price of less than \$50, you are getting a \$2,000 to \$3,000 machine for 2% of the cost.

In productivity software, some program areas have gained very widespread acceptance. Consider spreadsheets: When Visicalc was first available in 1979 and 1980, it cost about \$5,000 to get a complete setup of an Apple II, disks, monitor, printer and software.

People used to come and tell me how they replaced their time-sharing usage with new Apple IIs and paid for the whole system with just a few weeks of savings. Or they would use Visicalc to do reports in 15 minutes that used to take days of their time.

It was this "no brainer" decision to use Visicalc and an Apple that

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"In a relatively short period of time, we have seen the emergence of several distinct ages: the jet age, the atomic age, the electronic age and the space age. Each has changed forever the ways in which we live and think.

And we have seen the emergence of still another age, the age of information processing, which could prove to be the most exciting and interesting of all. For with increased information and the ability to move it rapidly from place to place can come increased knowledge, increased creativity and increased understanding among people.

In short, this new age can provide the antidotes for some of the human race's oldest diseases: ignorance, fear and suspicion.

Any age that can do that, I think everyone would agree, deserves the good will, best efforts and cooperation of all of us who are in a position to contribute to its realization."

JOHN AKERS
Chairman, IBM

helped get PCs into business. I never heard users saying that they loved Visicalc since it improved their productivity by 25%. Lotus 1-2-3 and the IBM Personal Computer extended that idea further by providing even more of the same type of improvement in a relatively upward-compatible way on a machine that was perceived as more appropriate for business.

Prior to spreadsheets, the Basic language was the major means of solving business problems on a personal computer. Spreadsheets were able to eclipse Basic in this regard because they were perceived as removing the need to learn to program.

They made the previously difficult task of formatting the input and output intuitive and trivial, and added the important ingredient of being highly interactive. As a result, a large nonprogramming population could be "computerized" for the first time.

Other ways of working with numbers have been packaged and promoted as major productivity improvements that complement or supplant spreadsheets.

Failed to gain major foothold

Invariably these products have failed to gain a major foothold in the marketplace because they don't provide a significant saving for the average user without sacrificing the advantages of the major spreadsheet programs.

In today's market, we are seeing that desktop publishing can pay for entire systems in just one or two uses by cutting down on typesetting fees and improving turnaround without requiring many sacrifices.

It is this type of payback, especially as the price of getting the output drops, that will make desktop publishing a major user of PCs.

Many of the areas in which you can get such great improvement are those where you computerize a manual task. That is why we frequently see the first entry in a category that meets the users' needs taking such a strong hold, usually only surpassed on new hardware or by products that are very upward-compatible. Computerizing a task already done well on similar hardware usually does not produce the large improvements I feel are required, unless the cost of switching is very, very low.

As new hardware and software become available at lower and lower prices, more and more tasks will be added to the computer's repertoire.

Only if those tasks can be done well enough by the computer that it would be foolish not to switch will they be added to the growing list of "major uses of computers."

People who sell computerized solutions with multiyear paybacks will continue to miss out on the rush to acceptance typified by spreadsheets.

Bricklin, president of Software Garden, Inc. in Newton, Mass., was the co-creator of Visicalc, the first electronic spreadsheet.

COMMENT

The world we live and work in is evolving rapidly. Local and national business and social issues become global issues.

Computers and computer networks are globalizing our society and have become the backbone of the information age. Millions of people worldwide have the capability to access information on thousands of topics.

The computer's capabilities have grown phenomenally since Eniac was first commissioned for service in 1946.

Computer graphics and imaging are now integral elements in all aspects of business from automobile design and safety to flight simulation for student pilots. Scientific research flourishes with the aid of computers, and some medical treatments would not otherwise be possible. In education, public and private school students can enhance their learning potential by taking courses long-distance via computers and public data networks.

A major social concern is that computers have the potential to divide our society into the computer literate and illiterate, with many advantages denied those who do not own or understand computers.

We must strive for universal education in the use of computers in our schools, on our jobs and in civic organizations to guarantee that all segments of our society benefit from the vast computer power available.

The computer will speed the evolution of our society more than any other technological gem ever invented. Each day the list of new computer applications grows.

Computers and the information highways that carry computer data are proliferating and should be exploited to the fullest. The information and computing power that is just a keyboard away should be used to optimize technical, natural and human resources.

As we commemorate the 40th anniversary of Eniac, we should remember that our knowledge in all fields has grown exponentially because of the computer. We must continue to probe for new computer applications so that our global society will become a better place to live.

PAOLO GUIDI
President, Telenet Communications Corp.

Rethinking 'Automation'

BY JOHN DIEBOLD

When my book *Automation* was published in 1952, it was two years before the first computer was ever installed for commercial purposes. Known popularly as giant brains, computers had only been applied for scientific and military uses.

Who ever would have believed that these strange new machines, which few people had ever even seen, were going to change the way managers make decisions, communicate with their peers, operate their plants and offices? Who would have accepted that computers would alter not only the nature of business but the society in which businesses operate?

That was the central argument of *Automation*. The difficulty lay in getting people to look beyond the machine hardware. In 1952 the computer was too big, too noisy, too expensive for practical use. One had to make a mental leap to understand that the underlying technology — information processing — was revolutionary, in that it had to do with a most fundamental determinant of human organization and behavior: information.

No one would doubt me today. The best run organizations in the world are well aware of the computer's impact on their businesses. Consider the example of General Motors Corp., which has become the world's largest manufacturer of process computers. The technology has changed every aspect of GM's business, from the way engineers design motors to the way car dealers service their customers.

Consider, too, the example of American Airlines, which recently made a multibillion-dollar investment in its automated reservations network. American acknowledges that its business is not selling airline seats but selling *information*.

It is natural that we should find enterprises entering whole new lines of business, seeing fundamental changes in their very mission or purpose, as a result of information technology.

It is natural that we should find enterprises entering whole new lines of business, seeing fundamental changes in their very mission or purpose, as a result of information technology.

I have long believed that automation, like any important technological innovation, brings about three phases of change: First you mechanize the work you did yesterday. Second, you find that the work itself changes. Third, as a result of the first two changes, the greatest change of all occurs in society.

By now we are well into the second and third phases of change. And yet, it seems to me that the really interesting developments have not yet started, or at least have yet to be fully recognized. Our current electronics revolution builds on a heritage of technological revolutions, so that by now we adjust almost unconsciously to change.

That is what enables us to proclaim widely that there is a revolution and then to virtually ignore the complex economic, business and social issues that we must master before we can say we have succeeded with our revolution.

The computer industry has grown over the course of three decades into a major industry, but it is now undergoing further shifts. It is no longer a capital industry producing only capital goods. It has also become a consumer-product industry, not only by way of direct products but indirect products as well: through the incorporation of chips into wristwatches, toys and all manner of consumer durables and nondurables.

What we are seeing is a technology increasingly embedded into our economic infrastructure. At the same time, computer resources are becoming as crucial to economic viability as energy and raw materials.

The technology is tied to the productivity of virtually all businesses and services, not just because it streamlines work, but because it affords the opportunity to analyze and rethink the jobs we do as individuals, as work groups and as large organizations.

This is where the really profound and subtle changes lie ahead: in the way we structure our work and our businesses. Very few companies are using information technology to redesign jobs, to change information flows in the business, to redirect processes.

Rethinking

In *Automation*, I described the rethinking process using the example of the New York Stock Exchange: It is not just a matter of adding gadgets to a centuries-old process of selling wares, but using the technology to redirect the information traffic.

Rethinking is not a simple process, which is why relatively few organizations have attempted it. An additional problem lies in the paucity of hard information on the way human organizations are structured.

Right now too much attention is

focused on simplistic cost/benefit equations to improve organizational productivity. By focusing instead on analyzing the quality and quantity of what we do, we will be better able to choose our own destiny, employing new technology in ways that are best suited to what we intend to do.

The social impacts

For the first time in history, we have a technology capable of adjusting to human needs, rather than the human being having to adjust to the machine.

As we learn to apply the benefits of this extraordinary programmability of computers, I believe we can expect great strides in the quality of life.

Already the human/machine interface is becoming simpler and more natural, enabling the computer to become a realistic tool for people in the mainstream of our society.

By this I mean a tool that brings us our daily news, moves us more quickly through the supermarket line, diagnoses our illnesses, delivers us theater tickets, gives us a direct vote in government forums and influences our leisure activities.

No doubt robots will play a more direct role in our everyday lives, although, as I stated in *Automation*, the human body is not the most practical form for a robot to take (in my book I used the term "flexible materials handling devices" as the terminology of robotics was yet to be coined).

It was the spectre of humanoid machines that unfortunately caused much of the initial fear and suspicion of computers.

When we arrive at the point at which robots are cheap enough and sophisticated enough to help the average citizen with housework and everyday chores, they might initially resemble the automated arms that build cars on an assembly line, or something more akin to a forklift than a metallic android maid or butler.

'Surrogates'

It is certainly possible that we will choose one day to have computers take on very human forms. MIT's Nicholas Negroponte envisions what he calls computer "surrogates" — the ghostlike images of helpful human servants, such as neatly uniformed letter carriers, responding to verbal or even nonverbal commands.

These surrogates would create a pleasing picture to embellish a service that the technology provides.

The intertwining of information technology with developments in biological sciences is inevitable. For instance, biologists have discovered that every living cell is actually a kind of computer, with enormous volumes of information encoded in spiraling strands of DNA.

So obviously biological computers might achieve a storage density, speed and sophistication far beyond what is possible with today's chip technology. The convergence of computers and biotechnology will have formidable repercussions.

Many years ago, Vannevar Bush predicted that computers would be implanted in every one of us. This prediction is already being realized to some extent, as microchips are embedded in heart pacemakers. And amputees are benefiting from electronic devices that enable them to move artificial limbs by merely thinking: Electronic circuitry replaces the broken nerve circuitry in the body, so that the brain can send messages directly to the limb.

The possibility of computers based on biological structures will open even wider possibilities for interconnectivity between human and machine.

A tool in human hands

I would not discount the alarming possibilities that human-machine hybrids present. Will we use such powers to extend and amplify human beings — or to diminish and control them? As with any new technology, it is no more than a tool in human hands. Intrinsically neither good nor evil, the technology challenges us to administer it wisely and fairly.

One cause for optimism is the fact that none of the early dire predictions about computers have been borne out. At the time of my book's writing, the stereotypical view held that computers would mean rigid systems: centralized, monolithic structures that would dehumanize work and everyday life. Today it's exactly the reverse: Systems are becoming decentralized, very flexible, very friendly and almost human.

Computers are opening up new opportunities to unleash the human imagination — the most important power we have. And what imagination will lead us to one can only begin to guess.

Diebold is chairman and founder of The Diebold Group, Inc., a New York-based international management consulting firm. He is the author of Automation, Making the Future Work *and* Business in the Age of Information.

Remembering 'Automation'

Reprinted from John Diebold's Automation. *Originally published in 1952 by D. Van Nostrand Co.*

■ **On the automated office.** The primary function of the office is the handling of information.

In the plant, the materials-handling problems are formidable obstacles to effective automation. In the office, materials handling is the basis for use of the new technology. We may deceive ourselves into thinking that the materials handled in the office are papers and cards, but actually the basic material being handled is information.

Although existing computers are designed to handle the information of the position of aircraft and problems in mathematics, these devices are readily adaptable to handling the information of business; and the information functions of business, in turn, provide a fertile field for automation.

As business grows and becomes more complex, the need for detailed, up-to-the-minute, accurate information increases enormously. Better methods of production control and market analysis, a growing body of government regulations, complex payroll deductions — all these are placing an increasing burden on office procedures.

Although we have developed some extraordinary machines for handling information, between 1920 and 1950 there was a 53% increase in the number of factory workers as compared with a 150% increase in the number of office workers. In addition, the office has moved increasingly farther away from the manufacturing process, both physically and functionally, although there are now signs of a back-to-the-plant movement.

In manufacturing firms, the function of the office is fundamentally related to the function of the plant. Recognition of this fact is of considerable importance to a fruitful analysis of office methods. When this basic relationship is overlooked, the introduction of new machinery often perpetuates existing procedures instead of eliminating or replacing them.

We have said that the basic form of the high-speed digital computer is ideally suited to automatic handling of business information. Indeed, the components of the computer — the input and output sections, the central control element, the arithmetic and the memory units — are all counterparts of the functions used in manipulating business problems.

For example, an employee analyzing a sales record will use as tools a record of past sales, a work sheet or scratch pad and perhaps a desk calculator. All of these elements, including the human functions of control and programming, are duplicated in the computer. The arithmetic element of the computer replaces the desk calculator as well as the comparison of data by the employee. The memory element retains the sales information that the employee retains on sheets of paper. The intermediate data, which must be set down by the employee as the analysis progresses, are retained in the memory circuits of the computer and erased when no longer needed. The outlining of the successive steps that the analysis is to follow, determined either mentally by the employee, by an instruction sheet or by a combination of the two, is determined in the computer by the control of programming elements.

Most writing on the subject of applying computers to the handling of business information has emphasized speed and accuracy as compared with present methods. But the new technology can do far more than improve speed and accuracy.

■ **On the office of the future.** Our clerical procedures have been designed largely in terms of human limitations. Humans can easily handle only a limited number of variables, and they can solve problems of only a given magnitude with speed and accuracy. Useful information concerning business operations often calls for too great an expenditure of human effort or cannot be analyzed by humans quickly enough to be used.

What the new technology offers is an escape from designing in terms of the limitations of human operators. And it is only when we learn to organize our information-handling procedures to take full advantage of the freedom offered by the new medium that we will receive the true benefits of computer technology.

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An analysis of the information function in business must be far more penetrating than the usual procedures analysis that now accompanies installation of office equipment. Procedures analysis resulted in a substantial portion of the overall savings associated with the introduction of punched-card equipment.

However, what is required is something similar to George Granger Brown's "unit operations analysis," which structures processes in terms of functional units common to different operations rather than in terms of the manner in which the processes are carried out. The question to be asked is not, How can we handle these forms more efficiently? but rather, How do we use the information contained on these forms? Why is it gathered in this manner? How does it relate to other information we need for operation of the firm? In what ways could this data be presented to management in a more meaningful form?

To use the new technology as a speedier means of preparing the same reports that are now prepared and to treat their contents in the same way they are now treated would be a great mistake. What the new tools offer is, in many cases, an entirely new way of handling business information.

■ **On decision support systems.** If the output of the computer circuits is in a form suitable for use in making management decisions, the computer is being used far more effectively than if it is employed to tabulate data that must be further manipulated by clerks before becoming useful to management. At the present time, much lower and middle management time is devoted to processing information and drawing from raw data the significant facts necessary for making top management decisions.

When a businessman is told that the new technology will provide him with much more information about the operation of his firm, he often shudders, because his desk and briefcase are already crammed with information he does not have the time to digest.

But, if used properly, the computer can do more than tabulate and print increasingly detailed versions of present reports. Used with proper understanding and insight, it can give management considerable relief from the perpetual dilemma of wanting more information, yet not having time to use effectively what is already available.

The computer can answer the many What would happen if . . . ? questions that cannot now be answered. Management can create projected operating data according to various hypotheses. By analyzing these hypothetical reports of costs, production and profits under various sets of operation conditions, much can be learned about the wisdom of alternative courses of action.

The rapidity with which even the slow-speed digital computers function means that operating statements, analyses of these data and other special reports can be scheduled and prepared daily with little effort. If need be, the computer system can be run throughout the night by a few operators and

provide detailed, literally up-to-the-minute reports each morning.

The results of using small IBM and Remington Rand, Inc. computers for the compilation of financial statements and payrolls already indicate that such speedy preparation is entirely possible. Fully integrated, automatic information-handling systems should substantially eliminate the present inability to obtain crucial operating information in time to make needed decisions on an intelligent basis. ligent basis.

■ **Integrating manufacturing systems.** In the fully automatic factory of the future, the information generated by the production processes will be automatically gathered directly from these processes. It will be possible for the central computing mechanism to keep a continuous running record of each part that is passing through the plant. If the individual machine control circuits are connected with the information-handling circuits of the office, an up-to-the-second, running record can be kept of the position of each part in the production process and of the number of acceptances and rejections at each stage in manufacturing. If a machine breaks down, the production of the other machines and the flow of product units between machines automatically will be adjusted by the computer to compensate.

By continuous monitoring of the inspection devices, machine failures can be reduced. The computer will take cognizance of the fact that trouble has begun and either correct it or inform the maintenance crew of the location of the trouble — all before the machine actually breaks down or before many parts are spoiled or before machining time is wasted on parts that will subsequently be rejected.

Production scheduling and production controls will be entirely automatic. Starting with the product output requirements of the plant, which are introduced into the computer machinery on the basis of management decisions, the computer automatically will schedule the entire production processes of the plant and will take into account disruptions that occur in actual operation.

By programming the machine with information now contained on parts lists, specification sheets, operation sheets and other forms used in production control, it is possible for the computer to determine the optimum runs for each production line, taking into account such variables as the cycle time of individual machines, machine availability, special requirements of certain components and the probability that delays will occur in specific areas.

Under the most progressive present systems of production control, parts lists and specification sheets are in the form of punched cards. These cards are processed by office machinery to determine the materials requirements for production. With computer circuits, not only will parts lists be compiled, but this information will also be used to determine the optimum scheduling of all production machines. Such automatic scheduling, it should be borne in mind, is done in terms of criteria that are built

To build a machine that will correct its own errors in accordance with criteria predetermined and built in by humans is very different from creating a machine that is human.

into the computer's programming. The enormously complicated problem of programming for tasks of this sort soon becomes evident.

■ **On robots.** Writers such as Norbert Wiener, by emphasizing the similarity of the automatic control systems and the nervous systems of humans and animals, have made the world of science fiction seem indeed to be upon us, with a race of human-like robots already in the making. No interpretation of the facts could be more perverse — or disturbing.

Robots — machines that look and act like humans — have been the subject of speculation and fantasy for many years.

Currently the subject is enormously popular, and the pseudoscientific language in which today's stories are told, when coupled with the animal-machine analogy of the Wiener school, surrounds the whole with an aura of reality. Even so recent and serious an account of the new technology as Edmund Berkeley's *Giant Brains* warns, "There seems to be no kind of escape possible. It is necessary to grapple with the problem: How can we be safe against the threat of physical harm from robot machines?"

But look at the facts. The solution of mathematical problems and other feats performed by computers do resemble the processes of human thought. But the resemblance is too superficial to warrant the conclusion that they think or are in any essential way human.

The problem is largely one of semantics. Our language has not yet developed the words that deal accurately with the new concepts. Even the word "computer" is hopelessly inadequate in describing what the machine is. In the broadest sense that we use the word "think," it can safely be asserted

that we have no machine that thinks. What a computer does is to carry out a logical process that is not at all human. To call it thinking would be as incorrect as to say that a typewriter has human characteristics because it can "write" this book.

The accounts that describe the new machines in human terms neglect one very important fact. Free will, the essential human quality, is absent from all of these machines. In no way can this quality be attributed to any machine yet developed, nor is there any indication that any such machine could be developed.

To build a machine that will correct its own errors in accordance with criteria predetermined and built in by humans is very different from creating a machine that is human. Even if it were technologically possible to build machines that could perform all the work that is presently performed by humans and that had the ability to think — and even possessed free will — there is considerable question, aside from all moral issues, whether we would economically want to produce such machines. From the standpoint of performing industrial tasks, humans are, in most cases, very inefficient. Oil refineries and automobile plants bear very little relation to the structure or the function of a human being. Human robots would thus replace humans in our present plant. But what a waste of investment this would be! For what a waste of human resources it is at present to have a human being, capable of all a human can do and feel and express, standing in an assembly line tightening nuts!

If we possessed sufficient technological ability to develop humanlike robots, what a waste it would be to go about our industrial tasks in the way we perform them today. How much better to build machines that could perform these tasks without having the added ability to play games of chess, to walk, to solve difficult problems and to communicate with others.

Automatic machines will thus not take on human form. Nor will they be all-purpose robots. The new technology permits the development of a group of much more automatic machines than we now possess. But such machines will be related to the machines with which we are familiar in the sense that they will perform certain groups of industrial functions and will vary considerably according to the functions to be performed.

The next 40: Software innovation

BY JOHN IMLAY

Chairman, Management Science America, Inc.

As corporations develop their long-range business plans, they will be including detailed information strategies. These strategies will revolutionize the way we do business today. And, they will be based not only on hardware, but on suites of applications software.

Software of the 1990s will be extremely user-oriented. Systems software of today, for example, operating systems, data base management systems and eventually expert systems and artificial intelligence, will become firmware and the user will only follow menus or verbal instructions as he inquires into the mainframe through a workstation. The mainframe will become an electronic library of corporate data for access by management, as well as for consolidation of final corporate figures.

Applications will produce not only resultant information for the end user, but will become predictive systems.

Suites of systems called "white-collar" software, for example, general ledger, accounts payable, accounts receivable and purchasing, will allow middle managers new freedom to analyze information in a more timely manner.

Software for all phases

These suites of software will be used in every phase of the corporation. Not only will there be white-collar software, but blue-collar software for shop floor control; open-collar software for computer-aided design; steel-collar software, including robotics of assembly and process control; and last but not least, button-down-collar software or executive information systems, which give information only to top management.

This software of the 1990s will allow the management and worker to execute their functions so efficiently that the time necessary to perform their jobs will be reduced dramatically. Society will then have its four-day work week and each job function will be more challenging because repetitive, redundant and boring elements of business will now be performed by the computer.

Software will be the driving force of this revolution.

As ease of use evolves out of artificial intelligence, literally every management employee will have the opportunity to communicate electronically all the business data necessary for him to function. AI will allow the computer to give only exceptional information, providing mission-critical solutions to the right manager at the right time.

The first 40 years of the computer age have been the hardware years. The next 40 will be led by software innovation.

An MIS guide for husbands, friends, wives and lovers

BY BRUCE KULA

Does a decade of nested IFs evoke for you the delicate beauty of a mountain waterfall in late spring? Is there nothing in your life so satisfying as tracing a storage chain through a 300-page dump?

If you answer yes, you may presume you are not an easy person to talk to about computers. If you have spent more than a couple of years in the world of DP, it's likely you have a whole vocabulary that is incomprehensible to someone outside that world.

It is impossible to speak computerese all day, then go home and not speak it at all. Words creep into your vocabulary that used to be out of place outside a computer room. Although some bits of computer language work their way into the common language, (such as the word "computer" itself — 30 years ago the laity called any computer "an IBM"), most DP jargon remains beyond the grasp of people who don't use it constantly. There is simply too much of it.

Programmers marry crane operators, and computer operators drink beer with corporate lawyers. Users have to talk to systems analysts, and data base administrators have to talk to management. It may be that the person closest to you doesn't even have a good idea of what you do for a living, much less understand the joys and tribulations of your work.

On top of this language problem, DP is new enough to be widely misunderstood. People with a slight knowledge of computers have some notion of how prosaic work with computers can be but often lack an appreciation for the remarkable technology involved.

More often, the layman's concept of computers comes from magazine articles with titles like "House of the Future" and "Cars That Think."

This is a specialized article, designed to provide an orientation for people who do not and may never program, use, design, operate or fix computers.

You who speak computerese have to help here — tear out this article and give it to someone you love. Then stand by to guide the person over the rough spots, illuminate with examples and, most importantly, add specific detail to areas that I have carefully generalized.

To the friend of the DP professional: Between 1981 and 1990, the U.S. Bureau of Labor Statistics says, the number of people who program, operate and repair computers will increase by up to 700,000, reaching almost two million. Add in people who enter data for computers to use, those who lack extensive computer knowledge but happen to use computers frequently on their jobs, and those millions who have bought their own home model.

All this is to say that you should not be surprised that you seem to know a lot of people who know computers.

You will have noticed, I think, that people who work with computers speak an esoteric language and do not exhibit much concern that others may not understand them.

Imagine you've come home after a hard day at work. You settle into your favorite chair with a glass of wine and a book. Suddenly, a crazy person explodes through the front door, ranting every bit as intelligibly as the foreman of the crew that built the Tower of Babel: "Trace

HANDS-ON

Punching in statistics at ringside

When Michael Spinks was training for his heavyweight championship bout, his sessions were punctuated with the tapping of computer keys. The noisemakers were Logan Hobson, Bob Canobbio and their Compaq Computer Corp. machine, analyzing the fighter's techniques.

The two ex-sports writers have built a thriving business in a little more than a year by using their portable to turn what they see into statistics that can be used by boxers seeking to hone their style and by those that cover sports. Their company, Compubox, Inc., has just become a division of Sports News Network International, Inc., and counts among its clients NBC, ABC, HBO, Showtime and the Associated Press.

Using a program they call Punch Stat, the two record the number of punches thrown, the number of connections made, whether the connections are visibly effective and where the shots land. Punch Stat was created to Hobson and Canobbio's specifications by a programmer who plays softball with Canobbio.

Having this kind of play-by-play detail is important to news outlets, Hobson says, because it gives them some extra insight into the dynamics of a fight. "If you are covering a bout and you know that one fighter, who is normally very effective, threw 792 punches but only connected with 278 or about 35% of them, then you have a pretty good basis for praising his opponent's slipperiness. It's certainly more interesting than just saying, 'So and So missed a lot of shots.' "

tables corrupted! Command reject on SYSRES!" the person shouts.

"Did you have a bad day?" you ask.

"All I did was add one little transient to the SDL!" the person raves on, swigging copiously from your wine bottle. You carefully move easily broken objects to higher ground.

You may recognize that lunatic as the DP professional in your life. Although things may not get quite so out of control in your household (they do in mine), probably you have noticed some communication problems when it comes to talking about computers. Perhaps you don't even have a clear idea of what that individual does all day.

And it's half your fault.

Oh, I know you've been sympathetic, and sometimes listened to computerese all evening long, without understanding half of it. But that's precisely the point: When you didn't understand, you should have raised a hand and said, "Hold it, Jack!" (or Jill, or Fred or Sue, as the case might be) — "What on earth are you talking about?"

People who don't understand computers will have the same status as people who can't read today.

It is possible you are less confused by people who talk about computers than you used to be. You probably have seen television programs where the hero (or, more often, villain) sits in front of a video display terminal getting at information stored in a computer system. In real life, you probably have seen a ticket agent or a bank teller do the same thing. And when a writer throws out a term like "video display terminal" you probably can visualize just the sort of thing he's talking about.

You have become, believe it or not, more computer literate than you used to be. For example: Do you ever use the word "input" — as in "I'd like to add my input to this discussion"? Were you using that word in 1970? Probably not. You have been exposed to the language of computers by the media and politicians and of course the people you know who know computers.

You may have heard warnings from university and government officials that people who don't understand computers will a few years from now have the same status as people who can't read today. Schools are forcing school boards and students to buy computers so the students will be prepared for a future that almost certainly will involve contact with computers.

Actually, the trend in computer technology is to design machines that anybody, with or without computer experience, can operate. The need for formal training to acquire computer literacy has already begun to decrease. Already, anybody old enough to read a simple sentence can use a well-designed computer system.

It no doubt sounds as if I am proposing arguments for not reading an article like this one. I haven't shown you the other side of the coin: The more user-friendly a computer system is, the more complex it must be. To make things easier for us (the users of computers), computer hardware and software engineers have to dig ever more deeply into their bag of technical tricks. It's very easy to design a computer that is difficult for anyone to use — and vice versa.

What this means, clearly, is that people who work in the world of data processing are going to have an even more sophisticated language all their own as the years go on, with more and more new and obscure terms. If you work with or live with someone in DP, both of you will have to work at understanding each other. And because the size of the DP lexicon is growing, it will be a never-ending job.

Is it worth the trouble? That depends on whether you wish to communicate with people in DP or merely listen to them. The purpose of this article is to

give you a running start at the former — and presumes you are tired of the latter.

Answer A or B to the following question: The computer is a useful device primarily because of its (A) speed or (B) intelligence.

If you answered B, or were tempted even vaguely by it, it is possible you have been convinced by magazines, newspapers, films or television that computers have brains. Not so. A computer is, at its roots, only a very speedy electronic calculator. It has no innate intelligence, although some computers may be furnished with instructions and information that allows them to mimic, in a small way, human reasoning.

Bad reputation

Yet somehow computers have developed a terrible reputation. Bank tellers blame them for losing your savings account, and customer service representatives point their fingers at them when the summer issue of a magazine arrives in your mailbox just in time for Christmas. In novels and films, computers are found doing everything from taking over the world to harboring indecent thoughts about a sexy heroine.

Actually a computer is not much more likely to lose your savings account than it is to demonstrate a lust for blondes. A computer, on its own, can't lose anything. (In fact, a computer is too ignorant to make any mistake. It requires that a human define the procedures it must follow to make a mistake.) And lust, of course, is an emotion, which is something a computer will never have. But about them taking over — there's some truth in that.

There may be computers skulking about your living room (in your television or stereo) or lurking in the shadows of your kitchen (in your microwave oven) or laying in wait somewhere under the hood of your car (a new car is likely to have half a dozen).

Computers are pervading our world not because they are smarter than you and me, but because there are so many tasks a computer can do more quickly, dependably and efficiently than humans can.

Let's take the problem 84,577,506 divided by 56,498. Not so bad. But try performing a million such calculations. It would take a person with average arithmetic skills a couple of years, with no breaks for eating, sleeping or sharpening pencils.

Yet the typical large computer could have the job done in a second — literally. Or let's say you've got to adjust two valves, one controlling gasoline, the other controlling air, making sure the right mixture is going into the cylinders of your car's engine.

The mix has to change according to acceleration or deceleration, the temperature of the engine and the load on the engine, and it has to change quickly and often.

Even if you could keep the valves adjusted properly (which isn't likely), you'd be bored to tears with doing it long before you reached Grandma's house. But a computer would do the job unflinchingly and perfectly for as long as it had current flowing through it.

A computer will do, mindlessly, precisely what it is told to do. Do not accept the explanation "computer error" when your checking account has an overdraft for $6 million. Tell the bank that programmers, keypunchers and computer operators make mistakes, but computers do not.

(I have to admit to one exception to this rule. It is possible for electrical or mechanical malfunctions to destroy or alter information stored in a computer. But a well-designed machine will detect a problem like this and allow a human to intervene and recover the lost information.)

A computer is a tool. So is a shovel. In two very different periods of our development, mankind invented them both. And there's nothing so very awesome about a shovel, is there?

Glossary

Glossaries usually are at the end of a book, because a glossary is normally an optional reference — a handy place to look up an unknown word.

Unfortunately, it is virtually impossible to talk about computers without

using specialized language. However technical a language computerese might be, most of it consists of ordinary English words bent to a special purpose.

The most common word in conversations about computers is **data**. It means information — and that's all you need to know. **Data processing** means doing something with information, but more often it is accepted as meaning a computer doing something with information. **DP** can mean the department where the computer is located ("Go see whether DP has any spare rubber bands") or what line of work someone is in ("I'm in DP") or a few other things.

Strictly speaking, the word data is plural, meaning more than one datum. For example, your Social Security number is a datum kept on file by the Internal Revenue Service, and your name and address are among the other data that are kept.

Unfortunately, data has come to be used for both plural and singular, so that one is more likely to hear the phrase "the data is correct" than "the data are correct." In lieu of the word datum, phrases like "piece of data" are in common DP usage.

A large computer is often referred to as a **mainframe** or a **CPU** (central processing unit); smaller computers are minis or micros. This discussion relates primarily to large computers, and a **computer**, as far as we'll be concerned, is a complex electronic device that can be directed to process data rapidly and accurately. Exactly what is meant by process depends on the particular **application**.

One application of computers is performing arithmetic calculations upon data, but there are other things that can be done to data: Data can be printed, tallied, sorted, compared, added to, deleted from, combined and translated, to name a few. And there are any number of ways in which the functions may be combined.

But before a computer will accomplish anything at all, it requires instructions. The act of writing the instructions in a language suitable for computers is called **programming.** A **program** is one set of such instructions, which would be written by, of course, a **programmer**. A **program** defines the procedures a computer must follow to accomplish some desired result. Usually more than one program is required to perform a job (a **job** is simply some task, defined by a human, that a computer is required to complete). Several programs that relate to each other — like all the programs relating to the processing of a payroll — are referred to as a **system**.

Because the programs that process payroll are applying the computer to a specific problem, they are known together as an **application system**. Such a system may consist of several jobs. In the example of a payroll system, a job might be run every two weeks to print paychecks, and another job might be run monthly to print a report for the president showing how much money was spent on overtime.

Another kind of system is the **operating system**. This group of programs does not produce anything as tangible as paychecks. It is both the servant and overseer of all other programs. A job will not start until the operating system ascertains it has the resources available to run it. An application program — like the one that prints paychecks — really submits requests for resources to the operating system and does not use the resources directly. So the paycheck program will announce to the **system** it has a check to print, and the system will actually issue the commands that initiate printing.

A computer is not much more likely to lose your savings account than it is to demonstrate a lust for blondes.

Notice that "system," with no qualification, usually means operating system. The operating system designed by one large computer manufacturer is called the Master Control Program, or MCP, a name that sums up the concept of an operating system neatly.

Programs are generally referred to as **software**, to distinguish them from **hardware**. Hardware means actual, physical devices, like a printer, or the computer itself. Software, as a rule, is what instructs hardware.

It is doubtful you can have avoided seeing the **output** of the sort of printer that is attached to a computer. Your monthly bank statement will almost assuredly be generated by a computer, as will any piece of junk mail that has your name inserted in it somewhere ("Dear Mr. Plunkett of Green Falls, Nevada, you may have won One Million Dollars!!").

This sort of printer was designed to accept different kinds of paper (**forms**) so that the same printer that was used to print the junk mail can later be used to print address labels for envelopes and a report on how many letters have been prepared. To avoid having to put a form in a printer every time a page is done printing, such printers use **continuous forms**, which are many hundreds of pages attached to each other but perforated in such a way that they may be separated after printing.

A necessary type of attachment to a computer is some **external storage device**, which allows large amounts of data to be saved and, in some cases, to be transported to some other computer or to a vault for safekeeping. The storage in a computer is not sufficient for large amounts of data and, because it is a special kind of electronic storage, it gets cleared out every time the computer is turned off. That kind of storage — **computer storage** — is for data and programs that the computer currently is using. **External storage** is for data that must be saved.

The two most common types of external storage are **tape** and **disk**.

Tape drives are much like a home tape recorder in concept: A roll of tape, with iron particles on it, passes by an electromagnet, which aligns the iron molecules on the tape.

Disk drives contain stacks of platters whose surfaces can be read by an electromagnet. The platters revolve at a high speed. When data is to be read or written, a device called a head moves to the proper spot along the radius of one of the disks and waits for the point on the disk to spin by that is to be read from or written to.

The advantage of this technique over tape is that data can be **randomly**, as opposed to **sequentially**, accessed. The situation is analagous to a cassette tape vs. a long-playing record. If you wish to listen to a song in the middle of the tape, you have to run the tape until it gets to the middle.

With the record, you could simply lift the tonearm and set it down at whatever song you wish. It works the same way with data: It is possible on a disk to access any datum almost immediately, without first accessing all the data that comes before it.

When data is stored on disk or tape, it is grouped together according to the way it is used, and each group is called a **file**. Each file has a unique name, like "BOOK.SUBSCRIBERS" or "EMPLOYEES." A file contains one or more **records**, each one containing different data. The file called EMPLOYEES might contain a record for each employee, and each record might contain an employee's name, address, Social Security number and pay grade. A group of files that has a logical relationship with each other is sometimes called a **data base**.

In the early days of computing, data was stored on punched cards. Although this technique is considered archaic in most DP circles, it does persist. To use cards for output from a computer, a device called a card punch is used; to use cards as input to a computer, a card reader is used. Card readers are used most often now merely to make the operating system aware of a job to be run, a process requiring only a few cards. This is called job submission.

It is not uncommon for all job submissions to be performed from a video display terminal, also called a **VDT**, a **cathode ray tube** (or **CRT** for short), a tube, a terminal or a screen. The fact that there are so many synonyms should suggest just how common these things

are. Software is available to allow many functions on a CRT. Programmers may use CRTs to write and change programs and to submit jobs to test the programs. Airline ticket agents use them to find out what seats are available on a particular flight. Entry clerks type in information about you on them when you subscribe to a magazine.

A special kind of CRT is used to monitor and control the computer and the jobs running on it. This is the **console**, and it usually can be found right next to the computer. The computer operator uses the console to communicate with the system. On most systems, several jobs can run at the same time — or that's the way it looks. Actually, the operating system divides up the use of the computer, doing a piece of this job, then a piece of that job, then a piece of this job again, going back and forth so quickly it appears to be running more than one job simultaneously. This is

It is rarely necessary for a programmer to have a detailed knowledge of how a computer works.

multiprocessing.

The ability to run jobs **concurrently** (which is not the same as simultaneously, remember) allows many computer users to make use of the same computer. Two basic kinds of activities may go on: **batch** and **on-line**. A **batch job** doesn't allow much human intervention, short of submitting it to the system. It requires a thorough explanation (to the system) about what data the job will require or write, what programs will be executed and so on. This explanation is submitted in a special **job control language** (or **JCL**).

On-line or **interactive** tasks are initiated by someone at a terminal. The information the system requires, about data and programs, has been supplied to the system already. All the terminal operator needs to do is type in requests and await replies, which will be presented on the terminal screen. In some contexts, the distinction between batch and on-line is denoted by background and foreground.

A different kind of program is required for interactive tasks than for batch tasks. Often a programmer will specialize in one or the other.

Programmers, like any humans, do not all speak the same language. Some write programs in **high-level languages** like Cobol, PL/I, Ada, Fortran, Basic or Pascal. High-level means "close to human language" (although a French Canadian might vehemently disagree). In Cobol, for example, if one wishes to display the current date upon the console, the correct command is: "DISPLAY CURRENT-DATE UPON CONSOLE."

Other programmers use a **low-level language** like Basic assembly language. This is a language more directly related to **machine language** — the language used within the computer — than to English. Any of the programmer languages must be translated into machine language before they are **executable** — able to be run on a computer. The programmer does not perform this translation by hand, of course; there is a program that does it for him, usually called a **compiler**.

Even once the program is translated to a series of digits that the computer will react to, there is no guarantee the program will work the way the programmer intended. It may not work at all. A program that isn't working properly might produce 1,000 pages of gibberish instead of the Year-End Profit Analysis Summary, or it may end abruptly before it has produced anything at all. The case of the abnormal end (or **abend**) is familiar enough to programmers that many not-so-technical terms are used to describe it: Programs die, blow up, cancel and crash, not to mention blow away, crap out and take a dump.

Whether the program's output is bad or nonexistent, the programmer must start the process of **debug-**

ging the program. As the word connotes, this means getting the **bugs** out of a program, correcting the things that are wrong with it. If the program **abended**, the operating system may have issued an **error message** at the time of the abend that describes the problem.

If this is insufficient, the programmer may have to study a **dump**. A dump is a printed listing of part of the contents of computer storage just as it looked when the program failed. This listing bears little resemblance to the program as the programmer wrote it. It's just page after page of numbers — a symbolic rendering of the machine language of the computer.

The languages used by programmers were designed to be understood by humans, not computers, so while a programmer has to know his language, it is rarely necessary for him to have a detailed knowledge of how a computer works. If you find the concepts discussed in this section difficult to grasp, don't feel bad; many DP professionals have the same problem. Of course, there are plenty of people who find the concepts childishly simple, and loads of fun, too.

Most of this article is concerned with what are called mainframe computers. These are large computers, which usually are capable of supporting multiple users, and which contain only the electronics necessary to process data — that is, any storage devices, terminals, card readers and so on are external to the computer; the computer itself tends to look like nothing more than a big metal box. Inside the mainframe are many circuits, logic boards, storage components and, usually, some kind of machinery for keeping everything from overheating.

A microcomputer, in contrast, typically contains a single microprocessor, a compact module about the size of a stick of gum, instead of the many components found inside a mainframe. Any of the personal computers on the market are micros, as opposed to mainframes. In between these two are minicomputers, which sometimes are a small collection of microprocessors combined in such a way that they act like a mainframe.

To further confuse matters, some of these minis are powerful enough to be called superminis, some of which have greater processing speed than some mainframes. But generally speaking, mainframes are the most powerful computers, microcomputers are the least powerful, and minicomputers are the machines in between.

Building micros

Microcomputers are much simpler to design, build and manufacture than mainframe computers. It is possible to buy the necessary parts to build a microcomputer for a few hundred dollars, put them together and sell the assembly for thousands of dollars — and many individuals have done just that. Some large and famous microcomputer companies started as tiny businesses in garages.

Another thing about micros worth noting is that it doesn't require much knowledge of computers to build one; what is more important is a knowledge of electronics.

As a result of these things, the language of microcomputers is very often different from the language of mainframes. For example, a mainframe operator performs an IPL (initial program load) to start the mainframe, whereas the owner of a personal computer will boot the system on the micro (from "bootstrap," which some early microcomputer designer imagined the micro pulling itself up by).

The primary device for storing information used on a micro is likely to be tape or disk (just like the mainframe), but the disk is often really a diskette or floppy disk (a flat sheet of plastic with a special recording surface, contained within a plastic envelope), and the tape can be a perfectly ordinary cassette of the same sort used to record music.

Because some microcomputers were designed specifically for home use, they have special features to make them easy to use. One of these is called a mouse, which is named for its appearance. A mouse is about the size and shape of half a tennis ball and is connected to the micro with a wire —

which suggests a tail. It can be pushed around on any flat surface, and moving the mouse causes some movement on the computer screen.

On the screen might be a list of names; to pick one, the computer user would roll the mouse around until an underscore character on the screen was under a certain name, then punch a button to let the program know a selection had been made. The program then might display information about the person selected. (By the way, that underscore character is known by most users as a cursor.)

Sometimes pictures will be displayed on a microcomputer's screen instead of words. With a system like this, the user might move the cursor to a picture of a printer, rather than typing in commands to initiate a print operation. It is becoming common to refer to these pictographs as icons.

Touch screens most natural

Some micro manufacturers have taken this a step further: Instead of moving the cursor to the icon one wants to select, the micro user can merely touch the desired symbol with a fingertip. Touch screens like this are believed by some to be the most natural way for a human to use a computer and, therefore, may be used eventually for all computers. The touch screen is covered with a touch-sensitive file, or the frame around the screen contains lights and sensors that a fingertip will block.

Whether the touch screen is a hint of the computer's future or not remains to be seen. However, graphics (like icons) will certainly continue to be desirable. Machines allowing the user to create pictures, graphs, architectural renderings and so on are relatively common. The person who creates such graphics usually wants to immortalize them and so requires a special kind of printer.

The most popular type of printer for attachment to a micro is a dot matrix printer. The dot matrix refers to the device that actually strikes the print ribbon or paper: It consists of 35 or more needles, each of which can be retracted or extended to form different characters out of the resulting dots. This allows a printer to be very fast, because the movement of the print head is only back and forth across the paper.

Crude graphics are possible with this type of printer, because it can be programmed to print dots anywhere on a page. Pictures composed of dots, like those printed in newspapers, are possible; however, simple bar charts, pie charts and special lettering are more common applications.

For the printing of more sophisticated graphics, a plotter is used. This is typically a very expensive and fairly large printer that prints with one or more fountain-pen-like devices moving over a stationary sheet of paper.

Word processing applications that demand letter-quality printing (like a business letter, a resume or a free-lance writer's manuscript) require a third kind of printer: a daisywheel printer. The daisywheel, usually made of plastic, is mounted between a hammer and a print ribbon. It consists of many spokes, and at the end of each spoke is a raised character, exactly like a hammer on a typewriter.

The wheel spins around when the printer is in use. When a daisywheel printer prints the character "a," it waits until the "a" spoke is in front of the printing hammer, the spinning pauses for an instant, and the hammer comes down.

As a rule, these letter-quality printers are slower than dot matrix printers, because the print mechanism not only moves back and forth across the paper, but it must wait momentarily for a character to come into position in front of the hammer. Their advantage is the appearance of their printing, which tends to be as good as that produced by an electric typewriter.

All these things may be of interest to a DP professional, even one concerned only with mainframes, because it has become desirable to establish communications between micros and mainframes. Departments of large companies and corporations have purchased microcomputers to help them do their work and are now discovering it would be a great advantage to have direct access to data stored on the mainframe system at the main office; main offices are discovering it is to their advantage to have access to their satellite micros.

For example, an insurance agent in Indianapolis might work for a company based in Chicago. Every month, the agent is mailed a list of rates for each kind of insurance policy, as calculated by the Chicago office. The agent types the rates into his microcomputer once a month, then uses the micro to create policy declarations for new clients. Then the agent prints a list of new policyholders and mails the list to Chicago.

Obviously the ideal situation would be for the agent to call in to his Chicago office's computer every morning to get the current rates, which would be downloaded to his microcomputer. When he typed in a new policy on his micro, ideally, that information would be automatically uploaded to the mainframe in Chicago.

Because this ideal is slowly becoming reality, DP professionals who are accustomed to mainframes are learning the language of micros and vice versa.

Kula is a software engineer for Paradyne Corp. in Largo, Fla. He now lives and writes on the shore of the Gulf of Mexico. This article originally was published in Computerworld *on April 29, 1985.*

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HISTORY OF COMPUTING

Mavericks, outlaws, dreamers & geniuses of the micro age

BY LAWRENCE MAGID

For the most part, magazines and newspapers are chartered with the job of reporting history, not making it. But in tbe early 1970's, two hobbyist magazines, *Radio Electronics* and *Popular Electronics,* were not content merely reporting on the changes in their fields. They decided to push things along.

One of the first major events in the history of the microcomputer was the July 1973 issue of *Radio Electronics* that carried a cover story by Don Lancaster detailing plans for a "TV typewriter." The article, according to micro pioneer Lee Felsenstein, served as a lightning rod for hobbyists throughout the country.

Although it resembled a terminal, the device had few practical uses and a lot of rough edges. To Felsenstein, that article "was the beginning of a mass learning experience." The design's "marginalities forced people to be creative. A lot of people got the article and got the parts and went around learning digital electronics the hard way."

A year later, that same magazine carried an article about the Mark-8, a "personal computer" based on the primitive and rather limited Intel Corp. 8008 microprocessor. When that article hit the stands, Les Solomon, the editor of *Popular Electronics*, decided to do his competition one better. He scoped out his readers and contributors and found a small company in Albuquerque, N.M., that, in Solomon's judgment, had the right stuff to create the first useful and powerful personal computer.

Solomon flew to Albuquerque to meet with Ed Roberts, the president of Micro Instrumentation Telemetry Systems (MITS). MITS, so it seemed, was down on its luck. It had been in the business of selling $99 calculators when Texas Instruments, Inc. and other semiconductor companies began flooding the market with cheaper and more sophisticated products. Rather than close up shop, Roberts accepted Solomon's invitation to develop a personal computer kit that could be sold for under $500. Roberts would build his computer around Intel's newer and more powerful 8080 microprocessor. Solomon, who helped sketched out the as yet undesigned computer, promised to showcase the MITS kit on the cover of his magazine.

The cover story of the January 1975 issue of *Popular Electronics* started a prairie fire. The Altair, proclaimed as the "first minicomputer kit to rival commercial models" was an instant success. Within weeks of the magazine's publication, hundreds of people sent in $397 for a 256-byte machine whose user interface consisted of a panel of switches and lights. Consider that 256 bytes represents 1 1/2560th the memory capacity of today's 640K IBM Personal Computer.

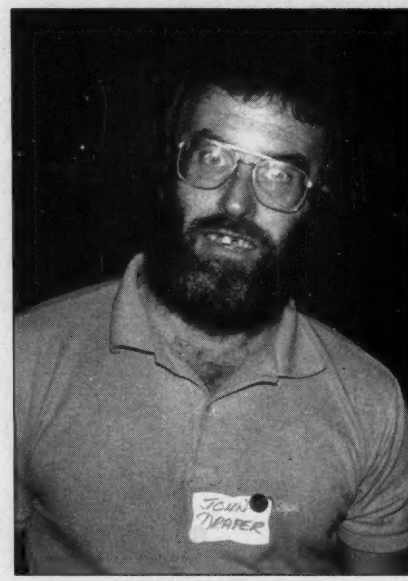
The machine was far from user friendly Programs were entered by flipping the switches, and data was read via a pattern of red lights. Steve Dompier, an early MITS customer, dazzled his colleagues at a meeting of Silicon Valley's Homebrew Computer Club when he demonstrated how the machine could make "music." Dompier positioned his Altair near a radio and relied on its radio frequency leaks to create audible and programmable sound patterns.

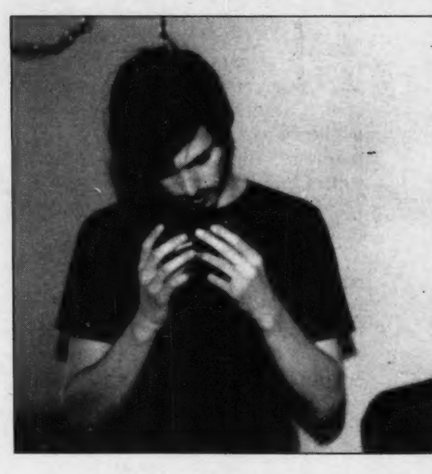
By mid-April of 1975, MITS had received more than 4,000 orders for the machine. Like the Apple Computer, Inc.'s Apple II and the IBM PC that were to follow, the Altair's greatest strength was its ability to help sophisticated users overcome the machine's own defects. That the machine was much less than perfect, combined with its expansion potential, made it a prime candidate for third-party engineers to create memory boards, I/O interfaces and other enhancements.

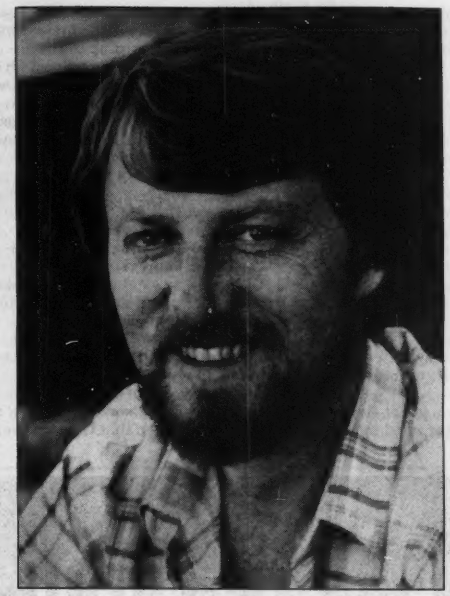
The fact that the machine was a real computer, not a dedicated single-purpose instrument, spawned a whole new industry — microcomputer software. It did not take long for word of the Altair to reach two young men in the Boston area. Paul Allen was working for Honeywell, Inc., and Bill Gates was a student at Harvard University. They called Roberts and asked if he would be interested in a Basic language for the machine. Roberts said he was, and a few weeks later Allen flew to Albuquerque to show Roberts the first version of what would eventually become Microsoft Basic.

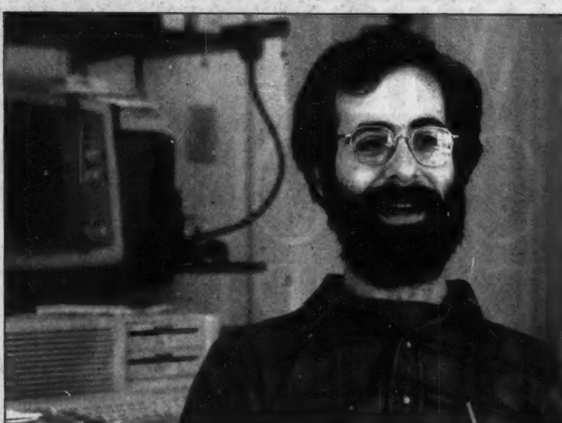
Gates and Allen's fledgling company, Micro-Soft, forged the first of a long string of strategic alliances that were to turn Microsoft Corporation into a long-standing industry leader and Microsoft Basic into a standard.

Felsenstein ingratiated himself with fellow Altair owners by developing some expertise in



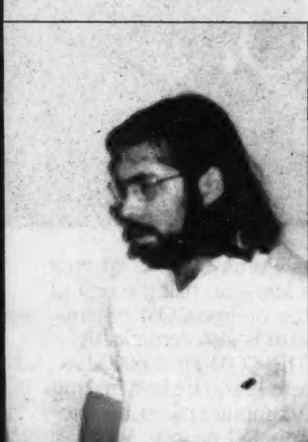






Irrepressibly witty George Morrow, founder of firms called Microstuf and Thinker Toys, with his latest company's Micro Decision computer (top left). Astrology forecasting machine builder and programmer Gary Kildall (top right). John Draper, alias "Captain Crunch," made tapping into telephone circuitry an art form (middle left). Quiet, unassuming Dan Bricklin (middle right) was catapulted into fame and fortune when he and Bob Frankston invented Visicalc. Draper's disciples, Steve Jobs and Steve Wozniak, known as "the Woz," launched Apple Computer in 1976 (bottom left). Hacker Bill Gates turned a hobby into a business with the founding of Traf-O-Data, later called Microsoft.

MORROW, COURTESY OF MORROW, INC.; JOBS, WOZNIAK, COURTESY OF MARGARET WOZNIAK



COMMENT

Has it really been 40 years?

One of the most intriguing aspects of the computer industry and its evolution is the element of time. High technology, as most of us think about it, is really just a thread in the fabric of time. But the roots of microcomputers and software technology extend far back into the history of man, well before the invention of the transistor in 1947 or the vacuum tube in 1904.

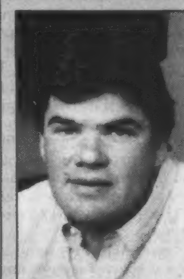
After all, the numbering system we use today is said to have its roots in India, circa 773 A.D. The concept of an algorithm, or a program's logic, came in the ninth century from an Arabian mathematician named Al-Khwarizmi. At the tender age of 19, Blaise Pascal invented the calculator that could add and subtract; that was in 1642.

The computer industry enjoys a rich and colorful history that may surprise many. Imagine that one of the first programmers in history was a countess named Ada, who worked with Charles Babbage and his analytical engine.

During the 1940s and '50s, the era of the Eniac, EDSAC and EDVAC machines, we find that the first programmer of the Eniac was a woman mathematician named Adele Goldstine. In the '50s, a mathematician and engineer by the name of Claude Shannon was first to describe how a computer could play chess.

It wasn't until 1951 that we saw the first commercial system with instructions resident in the computer, and that was the Univac I, built by the creators of the Eniac.

The software industry received a big boost in 1969 when IBM unbundled its software, opening the door for software pub-



lishers to compete in a fast-growing market.

But it wasn't until the late 1970s and early '80s that the use of microcomputers took hold in the business marketplace. Products like Visicalc, the first spreadsheet for micros, are often credited with legitimizing this market.

A few decades ago we were recording census data on computers so large that one filled an entire room. Today we are building artificial intelligence applications and expert systems on desktop computers. And what we considered AI a year or two ago is, to a great extent, now considered standard software programs.

Great things are being done in software today. Increasingly, software is the driving force behind advancements in the practical use of computers. We have only just tapped the surface of what is

PHILIPPE KAHN
President, Borland International, Inc.

....

"When we invented the personal computer, we created a new kind of bicycle . . . a new man-machine partnership . . . a new generation of entrepreneurs."

STEVE JOBS

debugging and repairing the new machine. "Altairs were persnickety," Felsenstein said. "We had noise and a lot of other problems to overcome. Its imperfection led to discovery and development." Felsenstein was among the few hundred San Francisco area innovators who came to meetings of the Homebrew Computer Club.

The energy level at the meetings was high, and the motivation, according to Felsenstein, "was definitely something other than money." Like many of the early Homebrew members, Felsenstein went on to make his own mark on the industry. He developed the Sol computer and was the principal designer of the Osborne 1. That machine, which was introduced in 1981, was the first fully equipped computer system, with monitor and I/O ports, for under $2,000, the first transportable computer and the first low-cost computer bundled with enough software to satisfy the initial needs of most business users.

George Morrow, who later designed several computers of his own, was one of the first engineers to design and market memory boards for the Altair. He distributed them by mail under the company name, "Morrow's Microstuff."

Morrow likens the early personal computer days to those of the wild west. "It was wide open. There were no restraints on what we did. Now that's not the case. There are traditions, there is momentum and we live in a society that has its rules."

Morrow likens the early personal computer days to those of the wild west. 'It was wide open. There were no restraints on what we did. Now that's not the case. There are traditions, there is momentum and we live in a society that has its rules.'

Indirectly, AT&T, then the nation's telephone monopoly, played an important role in the development of the microcomputer. The company's long-distance trunk lines became an unwilling playground for some early hackers, known as "phone phreaks." "Phreaking" is the fine art of breaking into long-distance phone lines for the purpose of making free calls. The ultimate high priest of that movement was John Draper, known throughout the early 1970s counterculture as "Captain Crunch." The nickname grew out of Draper's discovery that a whistle from a box of Captain Crunch cereal could generate tones that would give him access to the phone company's long-distance circuits.

Draper's legendary phone phreaking earned him lots of friends and admirers, including a budding young engineer from Cupertino, Calif. Steve Wozniak (also known as "The Woz") was so inspired by Draper's antics that he designed an electronic version of Captain Crunch's whistle. Dubbed the "blue box," Wozniak's invention allowed users to bypass the phone company's billing system, opening the door to unlimited free long-distance calling.

Like any other "useful" device, the blue boxes needed a marketing plan. To the rescue came Wozniak's good friend Steven Jobs. As legend has it, they made a tidy profit, though the proceeds from this activity were nothing compared to what the two young men earned from their first legitimate enterprise.

Wozniak took a job at Hewlett-Packard Co. and studied microcomputer processing at night. He also started attending Homebrew meetings which, according to the accounts in Paul Freiberger and Michael Swaine's colorful book, *Fire in the Valley*, (Osborne/McGraw-Hill, 1984) had an enormous impact on Wozniak's life. During this time he learned he could purchase a 6502 chip for only $20.

The Apple I

His first task was to write a Basic programming language for the 6502. Using the 6502 as its CPU, Wozniak put together a board with a keyboard and a monitor interface. The device, which he showed off at a Homebrew meeting, was called the Apple I. A few months later, with the help and encouragement of Jobs, Wozniak began work on the design of a more complete system that the pair eventually marketed under the name Apple II. The rest, as they say, is microcomputer history.

The Apple II might have been just a footnote to history had it not been for two men in Cambridge, Mass., who, in 1978, decided to use the Apple II as the platform for creating a computerized electronic spreadsheet program. Dan Bricklin, a student at the Harvard Business School, teamed up with programmer Bob Frankston to create Visicalc, short for "visible calculator."

"Apple," according to Frankston, "had just started marketing a floppy disk drive. Now we had a machine that we could do something with. The Apple II didn't impress me, but, with the floppy disk drive, it looked sufficient."

Frankston and Bricklin's decision to write Visicalc for the Apple II not only had a profound impact

on the destiny of Apple Computer, but also on its two main micro competitors, Radio Shack Corp. and Commodore Business Machines, Inc. With Visicalc, the Apple II suddenly became a tool for business. Despite the fact that it was a micro, and therefore regarded by many as a toy, the Apple II began showing up on the desks of financial planners, managers and number crunchers in businesses large and small. Radio Shack later marketed its own version of Visicalc as did IBM, when it introduced its PC.

In 1983, Mitch Kapor, who had earlier worked for Bricklin and Frankston, helping create a Visicalc companion program, introduced Visicalc's first major competitor. Lotus Development Corp.'s 1-2-3 has topped the charts ever since and quickly replaced Visicalc as the No. 1 selling business program. Lotus eventually bought the rights to Visicalc then stopped selling it. Frankston works for Lotus, and Bricklin runs his own small software company, Software Garden.

During the late 1970s and early 1980s, microcomputing was divided into two major and several minor camps. Most business users settled on machines based on the Intel 8080 or the compatible Zilog, Inc. Z-80 CPU. These machines ran the popular Control Program for Microcomputers (CP/M) operating system, which played host to Wordstar, an omnipresent and still very successful word processing program. CP/M machines could also run Dbase II, a serious data base management system, and Supercalc, a worthy Visicalc imitation.

The rest of the world was using the Apple II, Radio Shack Model 1 or 2, and some relatively obscure machines such as the Commodore Pet. The Apple II, which could not display lower-case characters without a third-party modification, became popular among educators, game writers and hackers. CP/M was the province of business. CP/M had been around even longer than the commercial machines that could run it.

Gary Kildall, a professor at the Naval Postgraduate School in Monterey, Calif., wrote the predecessor to CP/M under contract with Intel for that company's now ancient 4004 processor. With the 8008 and later 8080, Kildall refined his operating system and enabled it to read and write to floppy disks.

For years, CP/M remained the dominant disk operating system, with virtually no competition, other than Apple Computer's proprietary DOS. Then came IBM, which decided to commission Microsoft to create MS-DOS, which would drive its line of personal computers.

MS-DOS dominance

MS-DOS still dominates the personal computer marketplace. IBM may have to compete with hundreds of clone makers, but Microsoft owns the operating system market.

One major personal computer company refuses to march in lockstep. Apple continues to market and expand its Apple II line. As recently as this fall, it announced a major enhancement with the Apple IIGS.

For the business community, Apple offers its Macintosh line. Introduced in 1984 as "the computer for the rest of us," the Macintosh was touted by its evangelistic inspirer, Steven Jobs, as an appliance that would bring computing power to the masses.

During the past two years, the Macintosh has found an important niche, at least for the time being, as the machine of choice for the exploding arena of desktop publishing. Desktop publishing may turn out to be the Visicalc of the 1980s. Page-composition programs such as Aldus Corp.'s Pagemaker can transform a few thousand dollars worth of equipment into a typesetting, drawing and page-layout system, capable of replacing expensive equipment and services.

Desktop competition

Apple will not dominate desktop publishing for long. Already, several companies are releasing desktop publishing programs for the PC while IBM readies its recently announced desktop publishing business unit. And there, as we contemplate the near future, lies one of the lessons of microcomputer history: Energetic, sometimes ragged, young people and companies lay the groundwork and tinker with the possibilities. The boys with the money and big production and distribution facilities wait in the wings, ready to popularize, capitalize or, if necessary, imitate whatever seems to rise to the top.

It is hard to say if any of them will come up with tomorrow's history, but rest assured someone will. Have you looked into your neighbor's garage lately?

Historical Postscript: If some of this account seems like ancient history, check your calendar. It's only just begun. Jimmy Carter was halfway through his term when Wozniak and Jobs introduced the Apple II. The "good old days" of personal computing are still with us. Those of you who missed out can take heart. Sometime in the late 21st century, when historians reflect on the early history of the microprocessor, 1986 will seem awfully early.

Magid is vice-president and senior analyst in the San Jose, Calif., office of The Seybold Group. He is a syndicated columnist for the Los Angeles Times *and a former contributing editor of* PC World *as well as the former editor of* PC Magazine. *He is also founder and former chairman of Know How, a San Francisco-based microcomputer education company.*

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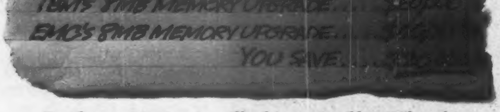

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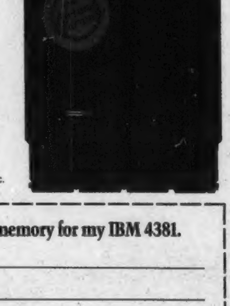

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Grace Hopper

First lady of programming

Rear Adm. Grace Murray Hopper, the woman who learned to program the first large-scale digital computer — the mechanical Mark I — retired earlier this year from the Naval Data Automation Command. Hopper, 80, then accepted a position at Digital Equipment Corp. as a senior consultant.

She learned to program the Mark I at Harvard University in 1944 while on duty for the U.S. Navy and stayed on to program the Mark II and Mark III. She worked for the Eckert-Mauchly Computer Corp. developing the Univac I. She was instrumental in the development of Cobol and still serves on the Codasyl executive committee.

Hopper spoke with Computerworld *Senior Editor Janet Fiderio.*

When you began work in 1944 on the Mark I, did you have any idea of the magnitude of the project or how far and fast computers would progress?

HOPPER: None at all. We didn't even know about transistors then. We didn't have magnetic storage. But Commander Aiken — Howard Hathaway Aiken — always said he was going to have a computer in a shoe box.

No one believed him?

HOPPER: No, not at all.

What I see now, after 40 years in the business, is the Model T of computers. I think we are just beginning. We've worked through the preliminaries.

What was it like for you to work on the Mark I?

HOPPER: I have always loved gadgets, and I like anything that works. When I saw a Mark I, all I could think was that it was the biggest gadget I'd ever seen, and I wanted to know how it worked.

You didn't realize that we would become so involved with the technology?

HOPPER: No way. It was wartime. We had problems to solve, so we didn't have any time to think ahead. Incidentally, Commander Aiken also predicted that specialized pieces of [computerized] equipment would be developed, and the first ones are coming out, the data base machines. I think we will see more developments like that.

What new products do you predict?

HOPPER: Well, I can think of graphics machines, and I see no reason why the operating system should stay in memory. Why can't we have an operating system machine, pull that system out and put it in the chips? We are just starting to think about these things.

Has society become too dependent on computers and technology?

HOPPER: Well, we used to be dependent on paper. What difference does it make that our information is on computers or paper?

Computers can fail.

HOPPER: And paper can burn.

So computers haven't given us a false sense of security or control?

HOPPER: No, some people say that you can get into a computer and access everyone's records. But to get into a computer and find a record, you have to know what you are doing. In the old days, if you went in the file room, you could pull anyone's file folder. It was all wide open.

Computers provide more security then?

HOPPER: Much more security. We must look at the issue with ordinary common sense.

Do you agree with the direction the computer industry is taking now?

HOPPER: It's hard to say because I don't know what's going to happen. I know for instance that in the next 10 years or so we will have computers driven by light instead of electricity. Optical technology is coming fast. But it is difficult to tell when you don't know what's going to happen. For instance, when I first rode in an airplane, a biplane, back in 1924, it was built out of linen, wire and wood. I could no more have dreamt of a 747 than I could have jumped over the moon.

In general, I think the computer industry has done amazingly well.

Which of your accomplishments are you most proud of?

HOPPER: All the young people I have trained. They are our future.

What type of encouragement would you give to young people?

HOPPER: I'd have them get in and learn about computers as soon as possible. Many of them are already doing that. I watched a third-grade class in Independence, Missouri, and those children were writing programs in Basic and debugging them. That gives me confidence in the future of the country.

If you were to go back, would you change anything in your career?

HOPPER: No. I've been perfectly happy and have had a wonderful time. The Navy has been good to me. When I needed training, they gave me training. When I needed an assignment, they gave me an assignmemt. Just think how lucky I was to be able to work on the first computer.

Have you directed your encouragement toward men and women alike through your work?

HOPPER: Very much so. But I will tell you one thing. I taught for 13 years at Vassar; then I joined the Navy; next I was on inactive duty and worked for Univac before working for the Navy again. Now, if you asked me which is best for women, I'll tell you the Navy. There is less prejudice in the Navy than there was in the academic or business world. We get the same rank and the same pay and the same opportunities.

Do you have any recommendations for women that have to work in the business or academic worlds?

HOPPER: Beat 'em. If it's a good idea, go ahead and do it. It's much easier to apologize than it is to get permission.

By revolution and evolution, PCs grow into business

BY JONATHAN ROTENBERG

If the development of the computer industry over the past 40 years seems spectacular, then the coming of age of personal computers in the last 12 years is nothing short of amazing. In this brief time, personal computers have evolved from maddening kits that only a few brave hobbyists could understand into useful tools that are reshaping the way many businesses operate.

In 1977, in the early days of The Boston Computer Society, getting a personal computer to *work*, let alone to do anything more useful than play "Kill the Bit" on its front-panel toggle switches, was an accomplishment to be celebrated. There were simply so many things that could go wrong. If you didn't have at least one degree in engineering and a very steady soldering iron hand, you hadn't a prayer of having a fully functioning PC.

Later that year, a rather radical idea came along. For the first time, PCs that you could buy, take home, plug in and actually use became available. These so-called "appliance computers" — the Commodore PET, Apple II and Radio Shack TRS-80 — suddenly meant that anyone could own a PC without being an electronics expert. Although it still wasn't clear what you would do with such a computer, since there was very little software available, all at once the computer age had been brought down from its ivory tower to a place where millions of nontechnical people could start to approach it.

The first real application software for personal computers — word processors and data bases — looked like badly lobotomized versions of mainframe programs. Steve Jobs once compared this fact to the introduction of television in the 1950s. The very first TV shows looked like radio programs with pictures added. It was quite a few years, Jobs pointed out, before producers began to see TV as an inherently different medium from radio and to take advantage of its unique potential.

Liberating potential

In the PC industry, it took just two years to liberate the medium's potential. In 1979, Visicalc was unveiled. This was the first commercial software package to truly exploit the new medium of personal computers. Taking advantage of the interactive, low-cost nature of the PC, VisiCalc was a new kind of personal tool for financial calculations. It was fast and easy, and it allowed users to try out different numerical scenarios and see the results instantly — a concept that would have been too expensive, too difficult and too impractical to implement on mainframes.

Most of the PC developments have, since 1980, been of an evolutionary, rather than revolutionary, nature. Yet they've been remarkable nonetheless. Personal computers have grown far more reliable, equipment costs have plummeted and many techniques have been developed to make complex tasks relatively easy for new users.

Although users today are quick to criticize manufacturers, and especially software companies, for their inconsistent customer support, few realize what phenomenal strides these companies have made in a very short peroid of time. Just a few years ago, most personal computer software was sold in plastic sandwich bags with a few sheets of photocopied documentation. These products typically had limited features and often could not be trusted to keep serious business data. Customer support phone lines simply did not exist. Yet today, a manufacturer that doesn't put as much effort into customer support as it puts into product development may quickly find itself out of business.

Precarious automation

Although there is much to feel proud about in the extraordinary accomplishments of the PC industry in the last 12 years, there are still some major challenges ahead.

In business, personal computers have reached only half their poten-

tial. As personal productivity tools that can help individuals write, plan, organize and communicate, PCs have been a big success. But as automation tools that actually run a business — its order entry, inventory or accounting, for example — personal computers have achieved only marginal acceptance. Especially for small businesses that don't have extensive in-house data processing talent, it's still too difficult and precarious to automate operations with a PC.

From a business perspective, automation applications are entirely different from productivity applications. Consider what happens, for example, when a disk is damaged or a file is garbled. With productivity applications, a user may experience several hours of frustration reconstructing his work. But with automation applications, a company may have to shut down until the problem is fixed.

Another major challenge is keeping personal computers easy to use. It seems as if every time the industry takes a step forward in making computers easier to use, it takes two steps backward in making them more complicated. As the industry responds to user demands for more convenience features, like desk accessories, windows, graphics support and networks, the user must become a sophisticated referee to make sure the features don't strangle each other.

And certain technologies, like local-area networks, are just too complicated for an average human being to deal with. When the industry can figure out how to make a local-area network that is as simple to use as the telephone — you just plug it in and it works — then this technology will be practical.

The final challenge for the industry is to ensure that as it matures, it doesn't lose its pioneering spirit of innovation. This is a tall order for an industry that also needs more standardization, but it's crucial to keep the technology vibrant.

The challenges for the personal computer industry are substantial. But considering what has happened in the last 12 years, it is hard not to be optimistic about what possibilities the future might hold.

Rotenberg is founder and president of The Boston Computer Society, the world's largest association of personal computer users.

"I have no belief in the idea of a computer being able to replace a man. I normally give credibility to very advanced thinking: Who knows? Who would have thought 200 years ago that we'd be flying around in the air? But as far as computers taking over the world, that's poppycock."

THOMAS J. WATSON JR.
former Chairman and CEO of IBM

Information society and the Control Revolution

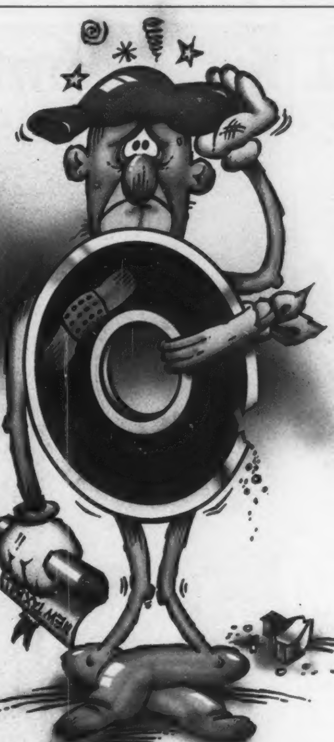
BY JAMES BENIGER

After 40 years, Eniac seems securely established as an icon in the history of computing. If we view computing as only one of several major developments in the emergence of our modern information society, however, Eniac appears closer to the midpoint than to the beginning. This broader historical perspective, I believe, will better serve us in understanding where the continuing development of microprocessing and computing technology — and of the information society more generally — might take us.

Twenty years before the first tube glowed in Eniac, America's top four information processing companies, with total revenues in 1928 dollars exceeding $150 million, were Remington Rand, Inc., National Cash Register, Burroughs Corp. and IBM — forebears of four of today's top five.

The companies owe their origins to four distinct innovations in the information machines of the 1870s and 1880s — the Remington typewriter, the cash register, the printing adder of William Burroughs and Herman Hollerith's punch-card tabulating equipment. We must look here, to the technological and economic innovations of the period from 1870 to 1900 — and not to Eniac and other developments of the 1940s — to find the truly revolutionary origins of the Information Society.

To say that the advanced industrial world has become an information society has become a cliche. In not only the U.S. but also Canada, Western Europe and Japan, the bulk of the labor force now works primarily at informational tasks such as systems



analysis and computer programming, while wealth comes increasingly from informational goods such as microprocessors and from informational services such as data processing.

Both the timing and direction of this great societal transformation can be measured using U.S. labor force statistics. In 1880, fewer than 7% of American workers produced informational goods and services, compared with the nearly 45% in agriculture. By far the fastest growth in information work came during the 1880s, when the sector nearly doubled to more than 12% of the work force. By 1930, fully a decade before Eniac's conception, the information sector had doubled again to occupy a quarter of all labor, compared with 35% in other industries and 20% in both other services and in agriculture.

Today, with many of those born in 1930 still in the labor force, America's information sector has doubled once again. Roughly half of us now earn our living from informational products, compared

Here, as in at least a dozen other countries, the processing of information continues to overshadow the processing of matter and energy.

with fewer than 30% from other services, 20% from other industry and scarcely 2% from agriculture. The manufacture of noninformational goods, the so-called "smokestack" industries, once the backbone of the American economy, may employ fewer than 15% of American workers by the end of this decade, even as farm work all but disappears. Here, as in at least a dozen other countries, the processing of information continues to overshadow the processing of matter and energy.

But why? Among the multitude of things that human beings value, why should it be information, embracing both goods and services, that has come to dominate the world's largest and most advanced economies? And why now? Information plays an important role in all human societies, after all. Why only in this century should it emerge as a distinct and critical commodity?

Answers lie in what I call the Control Revolution, a concentration of abrupt changes in the technological and economic arrangements by which information is collected, stored, processed and communicated, and through which formal or programmed decisions might effect societal control. From its origins in the later decades of the 19th century, the Control Revolution has continued to this day, sustained — in its more recent stages — by the appearance of business computers in the 1950s, microprocessors in the '70s and personal computers in the '80s, as well as by countless other technological developments.

To glimpse the future course of this change, the technological counterpart to the transformation of the American labor force, it might be useful to reflect on its initial cause. The Control Revolution began as a response to rapid industrialization after 1830 and to the resulting crisis in control of the material economy.

Before the application of steam power, even the largest and most developed economies ran literally at a human pace. Processing speeds were somewhat enhanced by draft animals and by wind and water power, but were still well within the information processing capabilities of individual human brains to control. System-level control could be maintained by relatively flat bureaucratic structures.

By far the greatest impact of industrialization, from the perspective of societal control, was to speed up the entire material economy, the system for the extraction, processing and distribution of commodities from environmental input to final consumption.

Almost overnight, with the harnessing of steam power, material flows could move 10 to 100 times faster, day and night, and in virtually any weather. This speed brought widespread breakdowns in control — fatal train wrecks, misplacement of freight cars, loss of shipments and the inability to maintain high rates of inventory turnover.

What began as a crisis of safety on the railroads in the early 1840s spread to distribution, or commission trading and wholesaling, by the 1850s, to products, or rail mills and other metal-making and metalworking industries, in the late 1860s and finally to the marketing of vast outputs of continuous-processing industries — flour, soap, cigarettes, matches, canned goods and photographic film — in the early 1880s.

Even the word revolution seems barely adequate to describe what followed — the development, within the span of a single lifetime, of virtually every basic information processing and communication technology still in use a century later.

These included not only the four business innovations already mentioned, but also telegraphy and rotary power printing (1840s), postage stamps and a transatlantic cable (1850s), paper money and modern bureaucracy (1860s), the telephone and switching exchange (1870s), punch-clock (1880s), motion pictures, magnetic tape recording and four-function calculator (1890s) and electronic

broadcasting (1900s).

Just as the Industrial Revolution marked a historical discontinuity in the ability to harness energy, the Control Revolution marked a similarly dramatic leap in the ability to exploit information.

Only from this perspective, I believe, can we hope to understand otherwise mysterious aspects of computer history. Why, for example, so many of the computer's major components had been anticipated by the mid-19th century, more than 100 years before their partial realization in Eniac. As early as 1833, Charles Babbage had designed his steam-powered Analytical Engine with the essential components of a digital computer: punch-card input and programming, internal memory or store, a central processing unit or mill and output that would be printed or set into type.

Babbage's designs followed by only six years his work on control of the British postal system and by one year the publication of his work, "On the Economy of Machinery and Manufactures," a pioneering treatise on industrial control based on exhaustive empirical study. His work was later reprinted as the first text on operations research. Six years after beginning work on his Analytical Engine, Babbage turned back to the crisis of industrial control in a series of studies of the Great Western Railway.

A century later in 1937, Howard Aiken, a former Westinghouse Electric Corp. engineer teaching applied mathematics at Harvard, drafted a proposal arguing that scientists needed more powerful computing. Inspired by Babbage's work on industrial control, Aiken included as an example the purposive monitoring and control of the material economy, what he termed the "science of mathematical economy."

As an appendix to the proposal which, funded by IBM, would in six years yield the electromechanical Mark I (a machine to rival Eniac in iconic value), Aiken included a gloss of Babbage's 1833 design — proof enough of the intellectual continuity of the Control Revolution over the intervening century. Indeed, Mark I was in many ways inferior to Babbage's design. The new machine lacked a differentiated processing structure and any general-purpose central processing unit.

Eniac itself might be seen not only as an early step toward modern computing, but also as the culmination of work on generalized information processing technology interrupted by World War II. Consider the intellectual as well as technological momentum the Control Revolution had gathered in the final pre-war years:

- In 1936, Alonzo Church, Emil Post and Alan Turing published separate papers equating decision and computability procedures.
- In Berlin that same year, Konrad Zuse began to build a universal calculator that used binary numbers, floating decimal point calculation and Boolean logic.
- In 1937, Claude Shannon published a paper equating logic and circuitry, Aiken and John Atanasoff worked out separate designs for calculating machines and George Stibitz built the first binary relay adder.
- In 1938, the Foxboro Company devised an electronic analog computer, and Zuse completed a mechanical prototype of his hardware.
- In 1939, three seminal machines — Atanasoff's electronic calculator, Zuse's binary relay computer and Stibitz's AT&T Model I — were all completed; IBM agreed to build Aiken's Mark I.

Information and control technologies continue to carry us toward possible confrontations with the prospects of artificial intelligence, computer consciousness, even synthetic life.

Even cybernetics, usually considered a postwar development, was largely anticipated in a paper published in 1940 by a British scientist, W. Ross Ashby. By the end of 1940, Stibitz had successfully demonstrated telecomputing, and Atanasoff had begun conversations with John Mauchly that would help to shape Eniac. Even though it would not appear for another six years, Eniac remained less modern — in some respects — than the prewar machines. It used decimal rather than binary numbers and hence could not exploit Boolean logic, lacked a general-purpose central processing unit and only partially distinguished processing from memory. To the extent that the control revolution continued on through Eniac, however, the machine remains an important milestone.

But why does the Control Revolution continue to this day, a century and a half since the onset of rapid industrialization? Several forces seem to sustain its momentum. Energy utilization, processing speeds and control technologies have continued to coevolve in a positive spiral, advances in any one factor causing — or at least enabling — improvements in the other two.

Additional energy has increased not only the speed of material processing and transportation but also their volume and predictability,

which in turn has further increased both the demand for control and returns on new applications of information technology. Information processing and flows need themselves to be controlled, so that information technologies must continue to be applied to higher and higher layers of control — certainly an ironic twist to a Control Revolution.

And what of the future? Most past attempts to forecast technological innovations or trends have proved worthless, at best, and certainly humbling. From the historical perspective outlined here, we might be tempted to conclude that — in at least broad outline — the Control Revolution will

Our information and control technologies continue to carry us toward possible confrontations with the prospects of AI, computer consciousness, even synthetic life.

continue into the near future much as it has over the century just past.

But even so cautious a forecast much be reconciled with perhaps the supreme dilemma of all control systems, including natural ecosystems: the greater the control, the more precarious and the greater the potential for loss of control — with more disastrous consequences. The Chernobyl disaster and recent airline tragedies illustrate how much more dangerous our control systems can make everyday life than it was in even the earliest days of industrialization.

Our information and control technologies continue to carry us, nevertheless, toward possible confrontations with the prospects of artificial intelligence, computer consciousness, even synthetic life. Intermediate forms already exist on both sides of life's boundaries: self-replicating polymers on the inorganic side, genetically engineered systems on the organic side.

Considering the continued development and proliferation of nuclear weapons technology, under the control of worldwide and extraterrestrial systems of growing complexity, evolution's next stage might hinge on the question of which boundary we reach first: synthetic life, certainly one possible product of growing control, or the return of the planet to the inorganic level, another quite possible outcome — ironically enough — of the same revolution in control technology.

Beniger is professor of communications at the Annenberg School of Communications, University of Southern California.

PHOTO COURTESY OF THE CHARLES BABBAGE INSTITUTE

Walter Cronkite (right) learns about Univac, which was to be used to predict the 1952 election, from Presper Eckert.

Census led computer age by counting on Univac I

BY JOHN KEANE
Director, Bureau of the Census

Most people agree that the age of the electronic digital computer began with Eniac. However, the computer revolution might never have occurred without the early interest in computer technology shown by the Bureau of the Census.

Even before Eniac was completed, the Census Bureau's Chief Statistician, Morris Hansen, had entered into serious discussions with J. Presper Eckert and John Mauchly regarding the feasibility of building a general-purpose electronic digital computer for large-scale tabulations of census data in 1944. Mauchly was particularly interested in constructing a more general-purpose computer than Eniac, and technical discussions on building the first such machine for the Census Bureau commenced in 1945. The discussions were soon widened to include engineers and scientists from the National Bureau of Standards, and this group held extensive consultations with various scientific panels.

Congress authorized a working fund to support this research, and the Census Bureau signed its first contract with Eckert and Mauchly in October 1946. The fund was administered by the National Bureau of Standards, which initially elected to award only a study contract for $75,000. The contract to build Univac I was awarded on June 25, 1948. The completed computer was turned over to the Census Bureau on April 1, 1951, and officially dedicated on June 14, 1951.

Univac I was operated for nine months in the Philadelphia manufacturing plant where it had been built. Because the computer was delivered about eight months behind schedule, it was too late to process more than a small portion of the 1950 Decennial Census.

The computing speed of Univac I was approximately the same as computers being built for military and scientific applications. But with the capacity to store 12,000 characters, Univac I's memory was larger. Machine stops were frequent with Univac I. When any one of the more than 5,400 tubes went bad, the machine stopped until that tube was located and replaced. Although the computer was operated around the clock, its actual productive time was rated at about 60% during the early years.

Univac I attracted worldwide attention when it became the first computer to be used by television news to predict the results of the 1952 presidential election. Walter Cronkite served as anchor of the 17-hour broadcast and Charles Collingwood ran "the Univac desk."

The Census Bureau's Univac I, serial number 001, contained 18,000 crystal diodes, required 18 kilowatts of electrical power to operate and weighed about 15 tons. Its memory unit was made of acoustic delay lines filled with mercury. It had 10 magnetic tape units that could read and write on plated metal tape at the rate of more than 10,000 characters per second. Auxiliary units included an operator's keyboard-to-tape device and a card-to-tape converter and several printing devices. Programs for Univac I were written in machine code — an alphadecimal programming language that required no assembler.

Early in 1953, Univac I was moved from Philadelphia to Census Bureau headquarters in Suitland, Md. It eventually logged 73,500 hours of operation before being retired from service in 1963. Although it took a lot of persuasion to convince Smithsonian officials that a machine that was only 12 years old was of such historic significance that it should be preserved, Univac I was officially accepted by the museum in 1963.

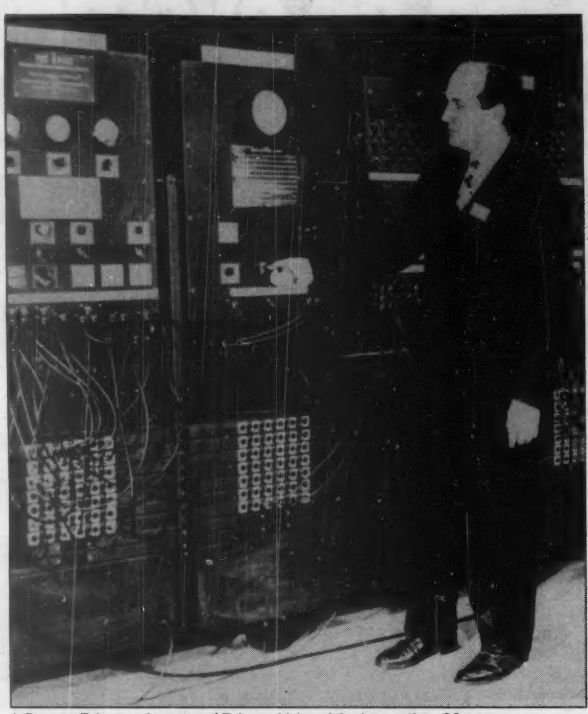
To document the Census Bureau's role in showing that computers had important applications outside scientific computing, the Census Bureau installed a historical marker in the Suitland office on June 14 of this year, the 35th anniversary of Univac I's original dedication.

The unveiling ceremony included remarks by Maryland Congressman Steny Hoyer; Kay Mauchly, a computer pioneer in her own right and the widow of John Mauchly; Carl Hammer, former chief scientist at Univac, retired; Morris Hansen, the man who led the efforts to acquire Univac I for the Census Bureau; and me. Futurist Alvin Toffler was the principal speaker. Walter Cronkite participated via videotape. The 350 invited guests included more than 50 Univac I pioneers — former Census Bureau employees who had worked on Univac I.

Census Bureau employees are proud that their organization took the calculated risk of moving from punch-card technology to computers before any other nonmilitary organization in the world. They feel that the Census Bureau had a bigger hand than Eniac in firing the computer "shot heard round the world."

Looking back: A 1949 view of the Eniac

This excerpt is reprinted from Giant Brains or Machines That Think, *by Edmund C. Berkeley, published in 1949. Berkeley is a technology consultant, president of Berkeley Enterprises, Inc. of Newtownville, Mass., and editor of the magazine,* Computers and People.



J. Presper Eckert, coinventor of Eniac, which weighed more than 30 tons.

As a general-purpose calculating machine, Eniac, the Electronic Numerical Integrator and Calculator, suffers from imbalance. That is to say, Eniac operates rapidly and successfully in some respects and slowly and troublesomely in other respects. This is altogether to be expected, however, in a calculator as novel as Eniac and made, to so large an extent, out of standard radio parts. It was certainly better to finish a calculator like this one and then start on a new one, as the Moore School of Electrical Engineering did, than to prolong design and construction indefinitely in order to make improvements.

Eniac adds or subtracts very swiftly at the rate of 5,000 calculations a second and multiplies at the rate of 360 to 500 calculations a second. Division, however, is slow, relatively: The rate is about 50 calculations a second. Reading numbers from punched cards, 12 a second for 10-digit numbers, is even slower. As a result of these rates, you find, when you put a problem on Eniac, that one division delays you as long as 100 additions or eight multiplications.

Ease of programming

Eniac allows very rapid and flexible automatic control over the programming of operations. It has more than 10 channels along which numbers can be transferred and more than 100 channels along which program-control pulses can be transferred. In addition, there are many ways for providing subroutines and there is no delay in giving the machine successive instructions: All the instructions the machine may need at any time are ready at the start of the problem, and indications occurring in the calculation can change the routine completely.

All these advantages, however, are paid for rather heavily by the slow methods for changing programming. To make a change, you have to plug in large numbers of program trunk lines and digital trunk lines, or you have to set large numbers of switches or both. Also, when you wish to return to a previous problem, you must do all the plugging in and switch setting over again. Many delays in the operation of the machine are the result of human errors in setting the machine for a new problem.

Here again, we must remember that Eniac was originally designed as a special-purpose machine for solving trajectories. To calculate a large family of trajectories, very little changing of wires and switches would be needed.

Memory

The most severe limitation on the usefulness of Eniac was, at the outset, the fact that it had only 20 registers for storing numbers. There are a large number of problems that cannot be simply handled with so small an internal memory. Even the Harvard University-IBM calculator is often strained during a problem because of the number of intermediate results that must be stored. The Ballistic Research Laboratories, however, have contracted for extensions to Eniac to provide more memory and easier changing of instructions.

Checking results with Eniac is not easy. There is no built-in guarantee that Eniac's results are correct, and a large calculator can and does make both constant and intermittent errors. Ways for checking with Eniac include the following:

- Mathematical, if and when available, and this will be seldom.
- Running the problem a second time, and this will, at most, prove consistency.
- Deliberate testing of small parts of the problem, which is very useful and is standard practice but leads only to a probability that the final result is correct.

You can operate Eniac one addition at a time, and even one pulse at a time, and see what the machine shows in its little neon bulbs. This is a very useful partial check.

Eniac's cost

The cost of Eniac is higher than that of some of the other large mechanical brains — over half a million dollars. Because some of the work was done at the Moore School by students, it is less expensive than it otherwise would have been. The largest part of the cost was the designing of the machine and the construction of the panels; the tubes were only a small portion of the cost, ranging in price from 20 to 90 cents each. However, no later electronic calculator need cost as much, for many improvements can now be seen.

The power required for Eniac is about 150 kW or about 200 horsepower, most of which is used for the heaters of the electronic tubes. With future electronic calculators using only a maximum of about 3,000 tubes, they are likely to use less than a quarter of the power needed for Eniac. Eniac will doubtless give a number of years of successful operation and be extremely useful for problems that employ its assets and are not excluded by its limitations.

In fact, at the Ballistic Research Laboratories, for a typical week of actual work, Eniac has already proved to be equal to 500 human computers working 40 hours with desk calculating machines, and it appears that soon two or three times as much work may be obtained from Eniac.

Computers take world closer to edge of catastrophe

BY EDMUND C. BERKELEY

The 40th anniversary of Eniac, which began useful operation in 1946, is an exciting occasion. Then, I was fortunate to be working as an actuary at the Prudential Insurance Company of America's home office in Newark, N.J., and instrumental in the negotiations that led up to the first commercial or business contract for an electronic automatic computer.

This contract was between the Eckert-Mauchly Computer Corp. (formerly the Electronic Control Co.) and Prudential. The preliminary contract depended on certain demonstrations to be successful and was intended to lead to a larger contract.

Prudential was cautious; John Mauchly and J. Presper Eckert had to experiment with new techniques, particularly writing and reading on magnetic tape. But there were troubles, and eventually Remington-Rand Corp. acquired Eckert-Mauchly Computer Corp., and IBM gained Prudential as a customer for automatic computing.

In January 1947, I met Mauchly and Eckert at a symposium on large-scale calculating machinery at Prof. Howard Aiken's Harvard Computation Laboratory. I liked and admired them greatly and saw much of them that year, and so was able to write a chapter on Eniac for publication in my first book, *"Giant Brains or Machines That Think"* (John Wiley and Sons, 1949 [see reprint at left]).

Benefit to humanity

We in the computer field in those early years were full of excitement and enthusiasm about the prospects of computers as a benefit to humanity. But we did not know, expect or even think much about the rather horrible dangers that have developed in the last 40 years that we can see now. But more about this later.

Eniac added electronically at the rate of 5,000 additions a second. Previously, the top rate of additions per second for a digital computer that used electrical relays was about three per second. So it became perfectly clear to almost everybody from 1946 on that computing had to be electronic and in the binary, not decimal, scale.

Currently, a supercomputer performs more than 10 million additions (floating point) per second.

It also became clear that Eniac's memory of 20 locations where changing numbers could be stored had to be enormously greater. Nowadays, even a personal computer will often provide

60,000 addressable locations where numbers (more accurately, bytes) can be pigeonholed like envelopes being sorted in a post office. The current cost of a personal computer far more powerful than Eniac is often less than $200.

It was clear to me, in talking with Mauchly and Eckert, that they had thought a great deal about the applications and implications of far more powerful computers than Eniac. These included computers that would promptly give large regional weather forecasts, a goal still not reached. They also envisioned computers that would solve many problems in the ways that human brains would or could solve them, but faster and better — a goal now being realized in expert systems.

Since 1946, vast progress has been made in programming, general-purpose programming languages and off-the-shelf software packages for thousands of applications. But the impetus of Eniac's achievement to this progress is less clear. In regard to reliability, Eniac set no records, made hardly even a ripple.

It is still true that checking results from an automatic computer is not easy. There is no guarantee that the results are correct. Various techniques, such as check digits (commonly used on bank account numbers), help to produce a very high probability that computed results are correct.

But errors in programming, of course, are not caught by check digits. The ratio of correct to wrong results, however, has been enormously improved during the 40 years from Eniac to the present, due mainly to hardware improvement — especially the discovery of transistors and the invention and rapid evolution of silicon chips.

To get good reliability out of large modern computer systems requires many different test problems to be repeatedly run, plus much patience, effort and time in debugging. Even then, there are errors. In 1986, a faulty revision of a computer program at Pacific Bell Telephone Co. allowed more than a million customers to conduct more than $29 million worth of long-distance calls without being charged.

Military funding

One more of the important aspects of Eniac was that it was an experimental development contracted for, and largely financed by, the Ballistic Research Laboratories at Aberdeen, Md., a division of the War Department, as it used to be called. The computer was built at the Moore School of Electrical Engineering in Philadelphia. Without military money, Eniac would not have occurred when it did.

The great expansion and evolution of the computer field from 1945 to 1986 would have been far less without military money: the funding from governments and businesses devoted to armaments and preparations for war, the large-scale killing of people.

Of course, war resulting in extinction is not new. When the Romans sacked Carthage in 146 B.C., 650,000 Carthaginians were killed and the remaining 50,000 sold into slavery and scattered. But the scale of disaster and destruction that would result from the combination of computers, communications, missiles and nuclear explosives is new, and it constitutes an appalling and horrible problem.

The 'final solution'

The primary problem that has developed from the computer revolution, of which Eniac was the great precursor, is that computer scientists, along with rocket and nuclear scientists, have become the engineers, the technicians of the "final solution." This term, borrowed from Adolf Hitler and his Nazis, was applied to non-Aryans and meant death for more than 10 million people in the concentration camps and gas chambers of the Third Reich.

The "final solution" for humanity currently is death for more than 5,000 million persons from a a nuclear holocaust and the nuclear winter, the outcome of the following:

- A nonrestricted arms race.
- The interwoven powers of the military/industrial/governmental complex.
- The mistakes, delusions and hallucinations of government leaders.
- The immutable laws of probability.

The recent nuclear accidents at Three Mile Island and Chernobyl and the devastation of Hiroshima and Nagasaki in 1945 are pale reflections of the existing real hazard.

Because of our modern computer expertise, the available time for drawing back from the brink, for preventing the launching of nuclear weapons in error, has shrunk to less than a few minutes.

There is no more important problem than substituting methods of nonviolent conflict resolution for methods of nuclear war.

In spite of the gloom given voice here, there are reasonable grounds for hope for the survival of humanity.

First, there is fear among the movers and shakers, the leaders and the governors of the fragile planet Earth. They now fear their own nuclear extinction.

Second, 41 years have passed without the war-like use of nuclear weapons. This lack of use may become a habit.

Third, even President Ronald Reagan says occasionally, "A nuclear war can never be won and must never be fought."

Finally, as more and more of the people of the planet realize the stakes, it is likely they will organize to prevent it.

Providing mankind with the ability to master the environment

BY ROBERT NOYCE
Vice-chairman and cofounder, Intel Corp.

Much has been made of the computer revolution, which we have seen accelerate since the first large-scale electronic computer — Eniac — appeared.

I find great similarities between computers and books. Both were initially used only by the few, by specialists, and were often kept in sanctuaries constructed solely for the purpose of housing them.

Both, through technological change, became useful to larger and larger segments of the population as costs declined and literacy expanded. Both deal with information and communication.

But there is an essential difference. The printed word serves to record, communicate and preserve information. The computer goes a step further, allowing the processing of information. Recognizing the implications of that extension of capability is fundamental to understanding what the computer will mean for the future.

The history of man has been his increasing ability to establish dominion over his environment. The first step of that process is observing nature, finding recurrent patterns and proposing truths or hypotheses about the way the world works.

Through ever more sophisticated observation and extrapolation from hypotheses, we have made great strides in understanding nature and through that understanding have been able to allow mankind an ever-increasing ability to master the environment.

Satisfying all our needs has been enhanced — whether they be basic needs of food, shelter and clothing — or the more esoteric needs of intellectual stimulation, entertainment or social interaction.

The process of extrapolation from hypothesis has become more and more complex. Much of science has been devoted to simplifying this process in order to achieve useful prediction and understanding.

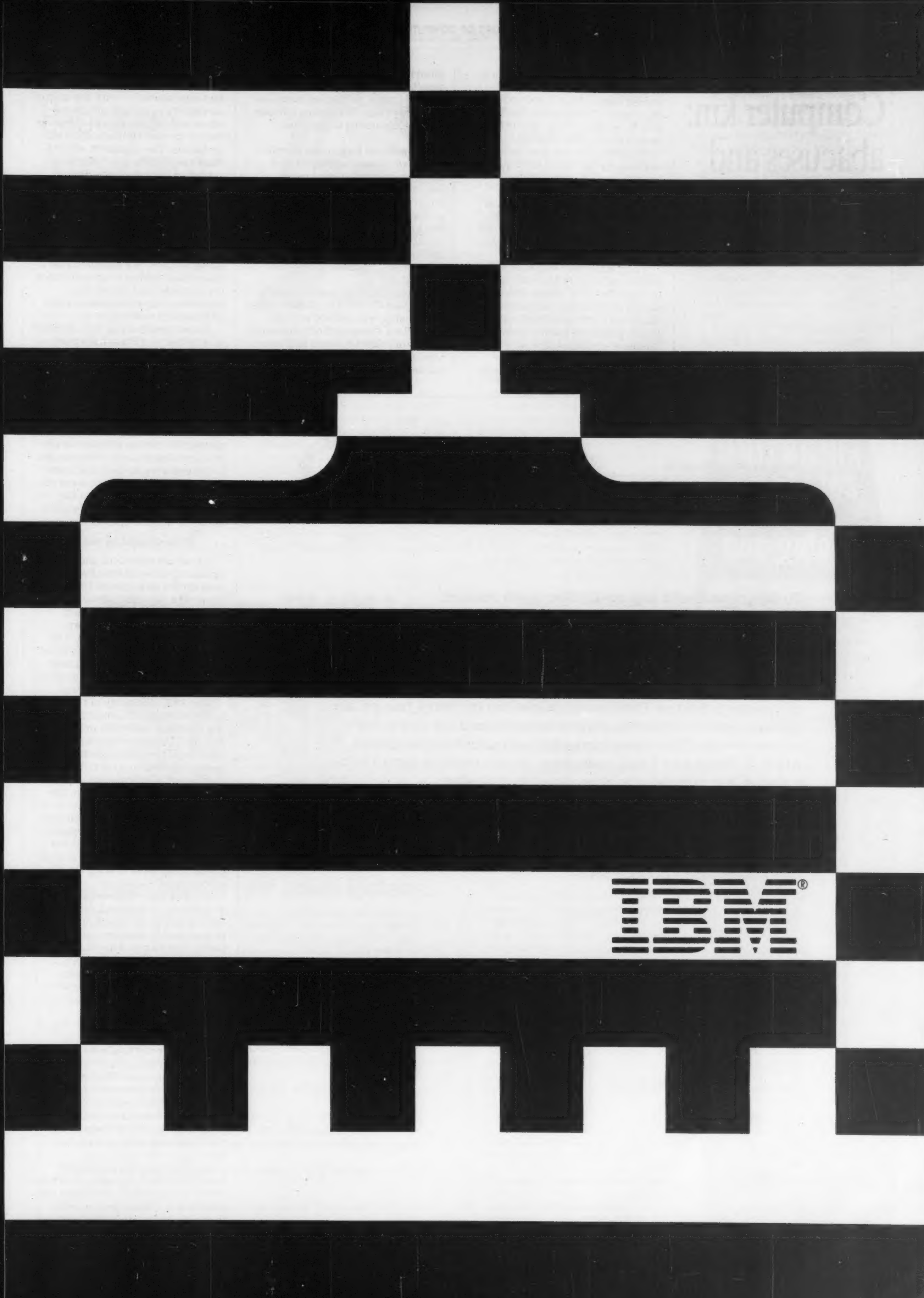
By providing a powerful tool for this extrapolation, the computer will continue to have a profound impact on science and, consequently, man's further understanding and mastery of nature.

Whether it be in simulation of the circuits for building new computers or

examining the structure of the basic components of life, the computer makes possible that which was impossible only a few decades ago.

Indeed, with each passing year, questions we have been asking since questions were first asked are being answered in a new way. What is life? Where did we come from? What was the beginning? Each answer recently has involved complex simulations.

The technology for building computers may be maturing, as did the technology for producing books. But not all the good books have been printed yet.


IBM®

Computer kin: abacuses and the checkered tablecloth

The earliest known mechanical counting aid is the dust abacus, traced back at least 5,000 years to the cradle of civilization, the Tigris-Euphrates Valley in southwestern Asia. The dust abacus was nothing more than a dust- or sand-covered surface on which figures could be drawn with a stylus.

The abacus, as commonly known, was invented in China in the second century A.D. The Chinese version and the Japanese soroban — both extraordinarily fast — are still in use today.

Their efficiency was pointedly illustrated shortly after World War II, when Pvt. T. N. Wood, the most skilled electric desk calculator operator with the American troops in Japan, pitted his talents against a Japanese soroban and went down to dismal defeat.

In various forms, the abacus existed in all the civilizations of antiquity. In ancient Rome, it was a grooved tablet, while in China, Japan and Greece, it remains a frame with beads strung on parallel wires.

In medieval England, a simplified form of abacus was formed from a tablet ruled into spaces, which represented the positions of the counters, with coins, buttons or other small objects moved to make the calculations. The checkered tablecloth, from which the British Exchequer derives its name, was originally a calculating device of this nature.

Also in England, approximately 2,000 years before the Middle Ages, Stonehenge was erected on Salisbury Plain. Composed of concentric circles of massive stones and other landmarks, the monument has long puzzled archeologists.

Considered by some an early astronomical calculator, Stonehenge has been shown — with the help of computers — to indicate the solstices and beginnings of seasons as well as predict eclipses of the sun and moon. The alignment of landmarks pointed to the rising and setting of the sun on the days of the summer and winter solstices.

A later astronomical computer, this one mechanical, was recovered from a sunken ship off the coast of Greece in the 1930s and attributed to the first century B.C. The device contains carefully designed gear trains that evidently turned indicator hands on its front dials at speeds exactly analogous to those of planetary motions.

In the first century A.D., Gerbert of Aurillac — a French sheperd boy who later became Pope Sylvester — made the first attempt in Western Europe to mechanize the abacus. Drawing on ideas he gleaned from the Moors, who then occupied Spain and Northern Africa, he spent many years trying to perfect his device, although it never worked accurately. He arranged 1,000 counters made of horn into 27 divisions. Since the concept of zeros was hardly known at the time, his device proved to be no better than hand operations.

Brass calculating machine

There are reports of another Spaniard named Magnus who then took up the idea around 1000 A.D. creating a calculating machine of brass in the shape of a human head, the figures of which appeared in the place of teeth. The priests of the day are said to have thought the device superhuman and smashed it with clubs, destroying all evidence of its accuracy.

The 1967 discovery of two bound volumes of Leonardo da Vinci's notebook materials in Madrid's National Library of Spain showed that the 15th century genius — never regarded as a contributor to the science of calculation — did indeed address the question. His drawings describe a machine that would maintain a constant ratio of 10:1 in each of it 13 digit-registering wheels. No working model is known to have existed and experts doubt Pascal ever saw da Vinci's sketches.

In 1614, John Napier, Baron of Merchiston in Scotland, discovered the logarithm, by which mathematicians could transform multiplication to addition and division to subtraction. Logarithmic tables remained the basis for lengthy computations until the early 20th century, when mechanical calculators came into their own.

Also developed by Napier was a device called "Napier's Bones," which amounted to a look-up table for multiplication. The "bones" were actually a movable multiplication table comprised of bone strips on which numbers were stamped. When placed into the proper combination, these strips could perform direct multiplication.

In 1623, the year Pascal was born, Wilhelm Schickard, a German professor of biblical languages and astronomy, designed a machine that reportedly could add, subtract, multiply and divide. Unfortunately, the model was destroyed in a fire and a new one was never built.

Babbage: A frustrated genius and his Lady Ada

May you never again claim to feel frustration after reading the story of Charles Babbage, a man before his time who spent most of his life in the vain attempt to manufacture a machine considered by most of his contemporaries to be utterly ridiculous.

In thousands of detailed drawings made 150 years ago, Babbage projected the fundamentals on which today's computers operate, but his ideas were met almost universally with ignorance and misunderstanding. If the technology of the 19th century had been equal to Babbage's genius, a computer would have been built in 1882.

But the technology was not there, and Babbage was destined to see the fruits of his labor only on paper and in theory. More than a century later, however, Howard Aiken, director of Harvard University's Mark I computer project, remarked, "If Babbage had lived 75 years later, I would have been out of a job." The historic Mark I, completed in 1944, was conceptually very similiar to Babbage's machine.

Charles Babbage was born on Dec. 26, 1791, in Totnes, Devonshire, England, into the fascinating and tumultuous epoch of the French Revolution. He was one of the two surviving children of Benjamin Babbage, a banker, and Betty Plumleigh Teape, both of Totnes and both descended from well-known Devonshire families.

As a child, Charles Babbage displayed a great inquisitiveness about the causes of mechanical workings. Upon receiving a new toy, he reportedly would ask, "Mamma, what is inside of it?" If the forthcoming answer was not to his satisfaction, the child would proceed to take the object apart to see for himself.

After a classical education at an old and venerable grammar school for boys, Charles entered Trinity College in Cambridge, England. There he continued the boyish pranks and rebelliousness that resulted from the boredom of often knowing more than his instructors.

Despite his unorthodox behavior, Charles was well on his way to absorbing the advanced theories of mathematics. With several others, he formed the Analytical Society to present and discuss original papers on mathematics and to interest people in translating the works of several foreign mathematicians into English.

At Cambridge, Charles's studies led him to a critical examination of the logarithmic tables used to make accurate calculations. He was well aware of the difficulty and tediousness of compiling the astronomical and nautical tables that were indispensable to the great maritime nation, and he was contantly finding and reporting errors in existing tables.

Babbage became convinced it was technically feasible to construct a machine to compute, thereby avoiding the numerous compositors' errors, 50 years before typewriters were invented.

One day, Charles was contemplating a problem while sitting in a room of the Analytical Society. Upon seeing Charles apparently in some far-off world, a friend asked him the nature of his dream. It is said that Charles pointed to some logarithmic tables and said, "I am thinking that all of these tables might be calculated by machinery."

The idea took firm hold in Charles's mind, and after graduation he returned home to begin sketching a machine by which all mathematical tables could be computed by one uniform process. He became convinced it was technically feasible to construct a machine to compute by successive differences and even to print tables when they were computed, thereby avoiding the numerous compositors' errors. It is noteworthy that Babbage's ambitious venture was undertaken 50 years before typesetting machines or typewriters were invented.

In 1916, two years after his marriage, Babbage had his first taste of worldly failure, closely followed by a second. His application for the professorship of mathematics at East India College in Haileybury was rejected for political reasons, as was his application, three years later, for the chair of mathematics at the University of Edinburgh, glittering recommendations notwithstanding.

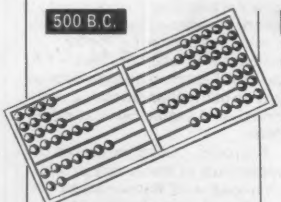
Fortunately, the elder Babbage gracefully supported Charles and family while Charles continued his feverish work on calculating machines. By the time he was 30, Babbage was ready to announce to the Royal Astronomical Society that he had embarked on the construction of a table-calculating machine.

His paper, "Observations on the Application of Machinery to the Computation of Mathematical Tables," was received with wide acclaim and Babbage was presented

The precomputer age

A time line, 500 B.C. to 1946 A.D.

500 B.C.



The abacus, a bead and wire "counting machine," originates in Egypt.

200 A.D.

Chinese mathematicians use the saun-pan, a "computing tray," while the Japanese use a similar device, a soroban.

524

Roman philosopher Boethius attempts to replace the standard European table abacus with one that uses fewer counters. His invention is not extensively used, and he is beheaded when he falls out of favor with the Goth King.

1000

Pope Sylvester II, then known as monk Gerbert of Aurillac, devises another, more efficient abacus, which again is not widely accepted. However, his calculations of future events prevent Christian Europe from collapsing in panic from believing that the end of the world is near.

1224

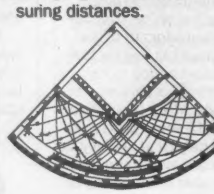
Albertus Magnus is rumored to own an "automaton" that is able to open the door and talk.

Computerworld time line compiled by **Michael Sullivan-Trainor.** Design: **Mitchell J. Hayes.** Photo research: **Christie Sears.**

Photos courtesy of: ***IBM*** *-Napier's Bones, Pascaline, Leibniz's calculator, Jacquard's Loom, Difference Engine, Scheutz's computer, Thomas Watson Sr., IBM building;* ***Culver Pictures*** *- Abacus, Ada Lovelace, World War II photo;* ***The Charles Babbage Institute*** *- Charles Babbage;* ***Burroughs Corp.*** *- William Burroughs;* ***Smithsonian Institution*** *- Herman Hollerith;* ***The MIT Museum*** *- Vannevar Bush;* ***Universum Film Aktiengesellschaft, Academy of Motion Picture Arts and Sciences*** *- Metropolis;* ***Hewlett-Packard Co.*** *- Garage Photo;* ***Iowa State University*** *- ABC Computer;* ***Harvard University*** *- Howard Aiken;* ***The Institute of Advanced Study*** *- John von Neumann.*

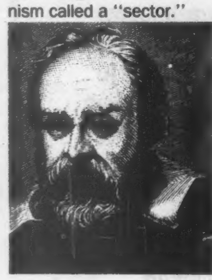
1430

A calibrated instrument known as a quadrant is developed in Europe for taking sights and measuring distances.



1606

Developing military technology gives rise to the need for instruments to calculate a gun's trajectory. This need is met by several inventors, including Galileo in Padua, who designs a mechanism called a "sector."



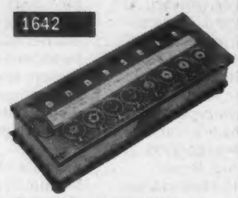
1614

Scottish nobleman John Napier develops the idea of logarithms in his work, "Description of the Admirable Cannon of Logarithms." Unfortunately for Napier, the book is dedicated to the Prince of Wales, who is later made King Charles I and is ultimately beheaded by Cromwell. Napier also devises a set of numbering rods, known as "Napier's bones," to ease the pains of calculations.

1622

William Oughtred, an English mathematician, develops the slide rule, which he calls his "circles of proportion" and considers a plaything not fit for use by true mathematicians.

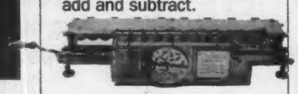
1642



French mathematician Blaise Pascal, the son of a tax collector, builds the first mechanical calculating machine to relieve his father of the tedium of adding long columns of tax figures.

1673

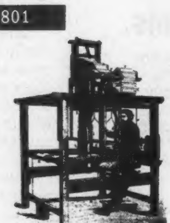
German philosopher Gottfried Leibniz builds a mechanical calculating machine that can multiply and divide as well as add and subtract.



1780

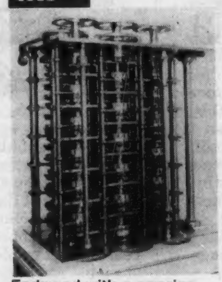
American Benjamin Franklin discovers electricity.

1801



French silk weaver Joseph-Marie Jacquard invents a punched-card-operated loom, modernizing his industry and inspiring Englishman Charles Babbage's plan to use punched cards.

1822



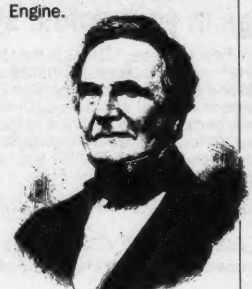
Endowed with a passion for accuracy, Babbage successfully designs a Difference Engine to calculate logarithmic tables. Beset by personal crises and uncooperative employees, Babbage spends more than 6,000 pounds of the government's money and draws from an inheritance of his own as well, but the machine is never built.

1831

Michael Faraday, the son of an English blacksmith, builds the first electrical generator.

1833

Babbage has a better idea. In striving to improve the design of his Difference Engine, he develops the outline for the first general-purpose computer, the Analytical Engine.



1842

Lord Byron's daughter, Lady Augusta Ada Lovelace, documents Babbage's work, becoming the first programmer. "We may say most aptly that the Analytical Engine weaves algebraical patterns as the Jacquard-loom weaves flowers and leaves," she writes. She also inspires Babbage, a man badly in need of inspiration, to continue his work. However, Lady Lovelace dies of cancer at age 36, and Babbage never completes his computer.

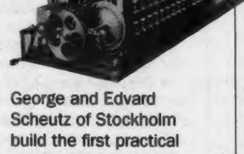
1846

Euphonia, a speaking "automaton," is exhibited by Professor Faber of Vienna. Designed to resemble abearded Turk, Euphonia can "whisper and sing" through the use of double bellows operated by keys and levers.

1854

English mathematician George Boole creates Boolean algebra and lays the groundwork for Information Theory. Raised in a lower class home, Boole's first revelations about symbolic reasoning occur at age 17 while he is walking across a field.

1855



George and Edvard Scheutz of Stockholm build the first practical mechanical computer. Their design is based on Babbage's work, and they win a gold medal at the Paris Fair for their efforts.

1859
England's Registrar's Office uses the Scheutz machine to predict life expectancy.

1886

Another inventor driven by the drudgery of manual calculation, William Burroughs, an American bank clerk, develops the first commercially successful mechanical adding machine. His company is the forerunner of Burroughs Corp.

1890
Facing the prospect that the current census would take more than 10 years to compile manually, the U.S. Bureau of the Census uses Herman Hollerith's invention, the first electromechanical punched-card tabulator.


1895
In a less urgent but just as profitable development, American Charles Fey invents the first slot machine, forerunner of video arcade games.

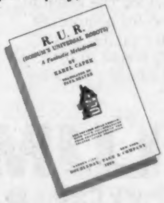
1896
After adding a sorting machine to his tabulator and seeing the census calculated in just three years, Hollerith decides it's time to go into business for himself. He founds the Tabulating Machine Co., and contracts with census takers soon roll in — including one for Russia's first census.

1903
Yugoslavian Nikola Tesla, who worked for Thomas Edison, patents electrical logic circuits called gates or switches.

1910
Hollerith's company sues the Census Bureau, claiming that machines developed for the agency by engineer James Powers infringe on his patents. The suit is disposed of without significant action.

1914


Thomas Watson Sr. is hired by Hollerith's company, now the Computing-Tabulating-Recording Co. (CTR), with 1,300 employees. The company resulted from the merger of the original Tabulating Machine Co. with the International Time Recording Co., the Dayton Scale Co. and Bundy Manufacturing Co.

1921
The Czech word "robot" is used to describe mechanical workers in Karel Capek's play, "R.U.R."


1924
Watson rises to president and CEO of his company, changing the name to International Business Machines (IBM).


1925

Vannevar Bush and colleagues at MIT build a large-scale analog calculator, the differential analyzer.

1926
Mechanical people appear in the movies in Fritz Lang's silent film, *Metropolis*.

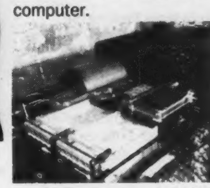

1927
Powers Accounting Machine Co., through a series of consolidations, becomes the Tabulating Machines Division of Remington-Rand Corp., which later merges with Sperry Gyroscope to form Sperry-Rand.

1928
Russian immigrant Vladimir Zworykin invents the cathode-ray tube.

1936
English mathematician Alan Turing publishes a paper outlining the theory of mathematical logic that illustrates computer design.

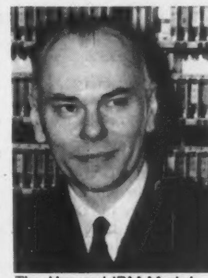
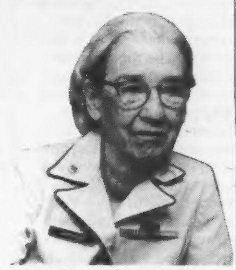
In Germany, Konrad Zuse designs the Z1 computer, with keyboard input, mechanical switches and a row of light bulbs to flash answers.

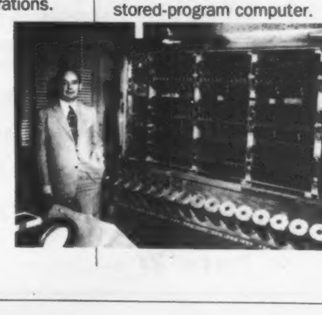
1938
Hewlett-Packard Co. is founded in a garage by David Packard and William Hewlett to make electronic equipment.


1939
Iowa State College Professor John V. Atanasoff designs a prototype for the ABC computer with the help of graduate student Clifford Berry. Not patented by Iowa State, the design is said to be the first working model of the electronic digital computer.

George Stibitz builds the Complex Number Calculator at Bell Labs, which some say is the first digital computer. Operating at a speed of about one minute per multiplication, the computer contains 450 relays and costs $20,000 to develop.

1941
Zuse builds the Z3 computer using electromagnetic relays. Operating at three to five seconds per multiplication, the Z3 is the world's first operational calculating machine with automatic control of its operations.

1943

Colossus, an electronic computer designed by Alan Turing, helps decipher German code during World War II.

The Harvard-IBM Mark I, an electromechanical computer, is completed by Professor Howard Aiken. The Mark I can multiply two 10-digit numbers in five seconds.

Grace Murray Hopper follows in Ada Lovelace's footsteps by beginning the first programming career. After entering the U.S. Naval Reserve, she works with Aiken to program the Mark I.

1945
American John von Neumann, an adviser on the Eniac project at the time, writes the "First Draft of a Report on the EDVAC," setting forth the precepts for a stored-program computer.


the first gold medal awarded by the Astronomical Society.

Now determined to similarly impress the prestigious Royal Society, Babbage wrote a letter to its president, Sir Humphrey Davy, stating that the "intolerable labour and fatiguing monotony" of a continued repetition of similar mathematical calculations had first excited his desire and afterwards suggested the idea of a machine that "by the aid of gravity or any other moving power" should become a substitute for one of the "lowest occupations of the human intellect."

A worthy cause

In 1823, the society agreed that the cause was worthy. In July, Babbage received 1,500 pounds "to enable him to bring his invention to perfection in the manner recommended."

In developing his Difference Engine, as Babbage called it, he studied the mathematical inventions of several predecessors, notably Charles Mahon, Third Earl of Stanhope.

Besides the gradually apparent implementation problems connected with the Difference Engine, problems also arose from a misunderstanding between Babbage and the British government, both of whom regarded the machine as personal property. Finally begun, the engine endured many permutations, improvements and modifications during the next four years, each one setting the project back to the beginning because of the need for specially created tools to construct the unheard-of parts of the machine. Babbage apparently had miscalculated his task; constructing the machine would have cost about 50 times what he was given.

Besides the implementation problems connected with the Difference Engine, problems arose from a misunderstanding between Babbage and the British government, both of whom regarded the machine as personal property. This caused problems for the next 20 years, delaying Babbage's work on the engine while he awaited further funds.

In 1827, in the midst of professional difficulties, Babbage was overwhelmed by a series of personal tragedies that included the death of his father, wife and two of his children.

These events took their toll, and Babbage fell ill. His family advised him to travel abroad for several months to regain his equilibrium. On his return, Babbage approached the Duke of Wellington, then prime minister, regarding the possibility of a further grant.

Help from Wellington

In the victor of Waterloo, Babbage found someone who could truly grasp the principles and capabilities of his machine, and the two remained friends for the rest of the duke's life.

The British government shortly thereafter granted him another 4,500 pounds, with a promise to furnish remunerative sums upon completion of the machine.

Babbage was struck by yet another brainstorm — he would design a machine that would be easier to construct, have greater versatility and operate faster than the Difference Engine.

His new inspiration, the Analytical Engine, would go beyond the Difference Engine and perform all arithmetic calculations, as opposed to a limited set, and would combine these operations to solve any conceivable arithmetic problem.

Engine features

The Analytical Engine included most of the essential features of today's digital computers, expressed in mechanical terms. The machine was to be divided into two parts — the "mill," in which arithmetic processes were carried out, and the "store," which contained the data to be worked on, as well as intermediate results.

The store would consist of 1,000 registers, each containing a 50-digit number. Numbers could be selected from the store, operated upon and the result returned to another location in the store.

The control of the whole process was to be carried out through a set of punch cards similar to those used in the Jacquard weaving loom, invented in 1801 and still in use today. Jacquard looms allowed the weaving of elaborate patterns as easily as older looms had made plain cloth, since the pattern of holes on each card — indicating the weaving design — was read by plungers that passed through them.

An all-important feature of the Analytical Engine was its ability to make conditional jumps. Mechanical means were provided to allow a band of cards to be advanced or backed, thereby jumping some cards, or repeating them.

Enter Lady Lovelace

Lady Ada Augusta Lovelace, the only legitimate offspring of the poet Lord Byron, was to dedicate the last decade of her short life to interpreting Babbage's Analytical Engine.

Now considered the first "programmer," Lovelace, like Babbage, was way ahead of her time, insisting on pursuing major intellectual ideas in an age when women were expected to voice their thoughts through their husbands, if at all.

By 1843, at age 28, Lovelace had mastered Babbage's plans for his engine and was as obsessed with the concept as he was. Lovelace channeled most of her talent and energy to further Babbage's cause. She eventually corrected some serious errors in his work.

One of her seminal ideas was that a large calculation might contain many repetitions of the same sequence of instructions, and she pointed out that by using the conditional jump facility, it should be possible to prepare only a single set of cards for the recurring instructions. She thus described what we now call a "loop" and a "subroutine."

The woman who possessed such vision and insight was to meet an excruciating end from cancer, at the age of 36, leaving Babbage once again alone to continue his unrewarding labors. In all, Babbage was to spend 14 years and 17,000 pounds on the Difference and Analytical Engines, neither of which would be built in his lifetime.

Ironically, Babbage's dream was to be partially realized by a Swedish printer, George Scheutz, who built a similar, workable calculator after reading an article on the Difference Engine in the "Edinburgh Review" in 1834.

Tabulating Machine

Scheutz and his son began work on the machine, designed for computing mortality tables, in 1837. Quite different in principle from Babbage's machine, Scheutz's Tabulating Machine was much smaller and consisted of four differences and 14 places of figures, but it was able to print tables.

To everyone's surprise, Charles Babbage did everything in his power to ensure the success of the new machine and was undoubtedly instrumental in its being awarded the French Gold Medal in 1855. The first model was purchased for $5,000 in 1856 and sent to the Dudley Observatory in Albany, N.Y.

At 71, Babbage agreed to have the completed section of his Difference Engine shown to the public for the first time. Presented at the Great Industrial Exhibition in London in 1862, the engine was finally shown, albeit "in a small hole, four feet, four inches in front by five feet deep," as Babbage put it. It was surrounded by other exhibits and no more than six or seven people could examine it at any one time.

Babbage's many disappointments led him to say he had never had a happy day in his life, and one of his friends observed that he spoke as a man who "hated mankind in general, Englishmen in particular and the English government most of all."

On Oct. 18, 1871, two months short of his 80th birthday, Charles Babbage was close to death. "It's a long time coming," he said to a friend. "Now I am going, as they call it, to the other world. Ask me any questions you like as to my feelings or thoughts and I will tell you."

History does not record what questions or answers may have been asked and given, but it does note that only a handful of mourners were at his burial six days later — proof that a man's greatness cannot be judged by the opinions of his contemporaries.

BAD NEWS:

Systems software problems are costly—in more ways than one.

Boole: Creator of a new logic — and, or, not

All the gear trains, stepped wheels, vacuum tubes or printed circuit boards in the world do not a computer make. Beside the immensely important mechanical developments of Pascal, Leibniz and Babbage, it took an entirely original theory of logic to ultimately breathe life into the machines that "think."

Expanding on Leibniz's "general method in which all truths of the reason would be reduced to a kind of calculation" set forth 188 years earlier, English mathematician George Boole in 1854 laid the groundwork for what we know today as information theory through the publication of his masterpiece, *An Investigation of the Laws of Thought, on which are founded the Mathematical Theories of Logic and Probabilities.*

In this work, published when he was 39, Boole reduced logic to an extremely simple type of algebra in which "reasoning" is carried out through manipulating formulas simpler than those used in traditional, second-year algebra.

His theory of logic, which recognizes three basic operations — And, Or and Not — was to become germane to the development of telephone circuit switching and the design of electronic computers. As with Leibniz's ideas, however, Boolean algebra was neglected for many years.

Nevertheless, few mathematical works of the past century have had as great an ultimate impact on mathematics and philosophy as Boole's book. The significance of the work was recognized by Boole's contemporary, the logician Augustus De Morgan. "That the symbolic processes of algebra, invented as tools of numerical calculation, should be competent to express every act of thought, and to furnish the grammar and dictionary of an all-containing system of logic, would not have been believed until it was proved in *Laws of Thought*," De Morgan said.

George Boole was born Nov. 2, 1815, in Lincoln, England, the son of a poor shoemaker. Although a contemporary of Charles Babbage, Boole was not born into the same privileged class, but rather was a member of the lower classes, a circumstance that made his early life extremely difficult.

Sprung from a stratum of society in which children were not expected to, and in fact were discouraged from, attending the university, George had to educate himself entirely on his own.

By the age of 16, it became necessary for Boole to go to work to help his parents. Taking a job as an "usher," or assistant teacher, in an elementary school, Boole was to spend four years teaching in two different schools.

Always with an eye toward improving his station in life, Boole began to consider the few options open to him. Since teaching at the level he was practicing it was not considered a profession or even a reputable trade, Boole looked to the church for his social salvation. He would become a clergyman.

When he was not teaching, Boole spent his time in serious study of French, German and Italian in preparation for his ecclesiastical life.

Unfortunately, his family's poverty once more disrupted Boole's plans. His parents urged him to forego the religious life in view of their ever-deteriorating financial situation.

Responsive as always to his parents' needs, Boole decided to open a school of his own even though he was only 20 years old. While working as a teacher, Boole always considered himself a student as well and proceeded to teach himself the body of higher mathematics as it then existed.

Major discovery

Early in his mathematical career, Boole made a discovery without which it is said the theory of relativity would have been impossible. He discovered invariants.

The fact that Boole saw what others overlooked and, even more importantly, recognized its significance, foreshadowed his future mathematical breakthroughs, which would not be truly appreciated until proven practical nearly a century later.

Once Boole's mathematical career got off the ground with the publication of his first paper, the question became how to make his ideas known at a time when opportunities for mathematical publication were limited. Boole did not belong to any of the learned societies that maintained their own journals, although he gradually developed friendships with many of the leading British mathematicians, either personally or through correspondence.

Part of the credit for Boole's later development of his theory of logic must be given to the intellectual climate in England at the time — exemplified by the British mathematical "reformers," including Babbage, D. F. Gregory, George Peacock, John Herschel and De Morgan, who together created the basis for the modern conception of algebra.

It was Peacock who, in his 1830 work *Treatise on Algebra*, broke away from the idea that the "x," "y," and "z" in such relations as $x+y=y+x$, $xy=yx$ and $x(y+z)=xy+xz$ necessarily represent numbers. They do not. Rather, they are arbitrary marks, combined according to certain operations and symbolized by "signs" in accordance with established postulates.

This renovation of algebra afforded Boole the chance to do work that was appreciated by his contemporaries, although symbolic logic was to lie fallow for many decades.

As late as 1910, for example, eminent mathematicians scorned it as a "philosophical" curiosity without mathematical significance.

Continuing his teaching chores without complaint, Boole finally got a break in the following year, 1849, when he was appointed professor of mathematics at the newly opened Queen's College in what was then called Cork, Ireland.

The appointment allowed him to

devote more time to his *Laws of Thought*, which he continually honed and perfected for five more years, until its publication in 1854.

As Boole wrote in the first paragraph of the book, "The design of the following treatise is to investigate the fundamental laws of those operations of the mind by which reasoning is performed; to give expression to them in the symbolical language of a Calculus, and upon this foundation to establish the science of Logic and construct its method; to make that method itself the basis of a general method for the application of the mathematical doctrine of Probabilities; and, finally, to collect from the various elements of truth brought to view in the course of these inquiries some probable intimations concerning the natue and constitution of the human mind."

Algebra of logic

Boole's work said in essence that while it is not true in common algebra, for example, that every "x" is equal to its square, it is true in the Boolean algebra of logic. According to Boole, $x^2=x$ for every "x" in his system. In numerical terms, of course, this equation has "0" and "1" as its only solutions.

Therein lies the importance of the binary system for modern computers — their logical parts are in effect carrying out binary operations.

Besides logic, Boolean algebra has at least two other important applications. The first of these stems from the fact that it is the natural algebra with which to treat the combination of sets of elements under the operations of intersection and union of sets. Considering also the idea of the number of elements in a set, Boolean algebra becomes the foundation for the theory of probability.

A man ahead of his time

In spite of its subsequent importance to many other branches of mathematics as well as the development of the computer, Boole's monumental work was to remain only a curiosity for many years.

Like Babbage, Boole was a man ahead of his time. It was not until Alfred North Whitehead and Bertrand Russell published their three-volume *Principia Mathematica*, written from 1910 to 1913, that serious mathematicians began to study formal logic.

Because Boole demonstrated that logic can be reduced to very simple algebraic systems, it was possible for Babbage and his successors to design mechanical devices that could perform the necessary logical tasks.

The year after he published his *Laws of Thought*, Boole married Mary Everest, niece of the Professor of Greek at Queen's College. The marriage would last only the nine years remaining before Boole's untimely death at the age of 49.

Honored and with a growing fame, Boole died on Dec. 8, 1864 of pneumonia reportedly contracted after he kept a lecture engagement even though he was soaked to the skin.

Mary Boole, who had become a devoted disciple of her husband, published a pamphlet after his death in which she stated some of his ideas — no doubt stemming from his many years as a teacher — on the need to rationalize and humanize the education of young children.

In *Boole's Psychology*, Mary Boole recounted a significant event in George Boole's life. He told her that when he was about 17, it "flashed upon" him as he walked across a field that besides the knowledge gained from direct observation, man derives knowledge from some undefinable and invisible source, which Mary Boole called "the unconscious."

Further evidence of his belief lies in the closing pages of *The Laws of Thought*, in which Boole cites "the error of those who regard the study of Mathematics, and of their applications, as a sufficient basis either of knowledge or of discipline."

It was the powerful combination of intellect and intuition in George Boole that resulted in the several mathematical milestones he contributed.

"By 1958 or 1959, we realized that we had water in relatively large quantities, so to speak, and the market was a dry sponge. If we could just learn to introduce that water into that sponge in acceptable form, there was no limit to where this business could go."

THOMAS J. WATSON JR.
Former Chairman, IBM

Hollerith: Punch cards launched the technology that changed the world

While computers have not eliminated delays in the issuance of reports from the U.S. Bureau of the Census, it was just such delays that a century ago led to the development of more advanced computer technology.

In 1880, thousands of human beings manually counted the census results. No matter that the workers were diligent; the task took 7½ years, by which time the figures were close to useless.

During those 7½ years, a young Census Bureau engineer, Herman Hollerith, attacked the problem of statistical tabulation. Through trial and error, diligence and a fateful conversation, Hollerith — echoing Charles Babbage's plans to use Jacquard loom-inspired punch cards for the Analytical Engine — set in motion a technology that would change the world.

Hollerith was born in Buffalo, N.Y., on Feb. 29, 1860, the son of German immigrants. The only noteworthy problem in his childhood was an immense dislike for spelling. It is said that, in an effort to avoid a spelling lesson, he once leaped from a second-story window and ran home. Hardly an illustrious beginning.

At Columbia University's School of Mines, Hollerith's work drew the attention of one of his instructors, Professor William P. Trowbridge, who was also a chief special agent for the 1880 census. Trowbridge recruited Hollerith for the census, where he went to work in October of the year he graduated.

It was Hollerith's association with his superior at the Census Bureau, John Shaw Billings, that led directly to the idea for a punched card tabulator. Billings was in charge of the network on vital statistics for both the 1880 and 1890 censuses — specifically, the collection and tabulation of the data. And it was Billings' suggestion to Hollerith that Jacquard-like punched cards might be the answer to the massive tabulation problems of the census.

In September 1882, Hollerith temporarily took leave of the Census Bureau to accept an invitation to teach mechanical engineering at MIT. General Francis Walker, also from the Census Bureau, had become president of MIT and had extended the invitation.

"While at Boston, I made some of my first crude experiments in tabulating machinery," Hollerith wrote. "My idea at that time was to use a strip of paper and punch the record for each individual in a line across the strip.

"Then I ran the strip over a drum and made contacts through the hole to operate the counters. This, you see, gave me an ideal automatic feed," he noted. "The trouble, however, was that if, for example, you wanted any statistics regarding Chinamen, you would have to run miles of paper to count a few Chinamen."

Hollerith claimed that a major breakthrough in his work came from his observation of a train conductor, who hand-punched tickets to record basic descriptions of his passengers. Hollerith felt the same technique could be used to record the proper census statistics for each individual in the U.S.

Devoting his efforts wholeheartedly to the construction of his statistical tabulating system, Hollerith applied for a patent on Sept. 23, 1884. Hollerith eventually accummulated 31 data processing patents.

In 1890, three major events happened in Hollerith's life. He married Dr. Billings' daughter, he received his Ph.D in philosophy from the School of Mines for his dissertation on "The Electric Tabulating System" and the U.S. conducted its 11th census — using his system.

Before being awarded the contract for the 1890 census, Hollerith had competed with three other proposed systems, all of which took about eight times as long as Hollerith's to tabulate the results. In addition, Hollerith's was about twice as fast as his nearest rival in total time spent transcribing and tabulating.

Just one month after all the 1890 census returns arrived in Washington, the bureau announced the total population count of 62,622,250 on Dec. 12, 1890. Although the population of the country had grown from 50 million to 63 million since the 1880 census, the complete 1890 analysis was completed in two and a half years, or in one-third the time previously taken.

In an 1891 paper on the subject, Census Superintendent Robert Porter said "The eleventh census handled the records of 63,000,000 people and 150,000 minor civil divisions. One detail alone required the punching of one billion holes. Because the electrical tabulating system of Mr. Hollerith permitted easy counting, certain questions were asked for the first time. Examples of these were the following:

- Number of children born.
- Number of children living.
- Number of family speaking English.

By use of the electric tabulating machine, it became possible to aggregate from the schedules all the information which appears in any way possible," Porter continued. "Heretofore such aggregations had been limited. With the machines, complex aggregations can be evolved at no more expense than the simple ones."

What exactly was the system that revolutionized census taking and eventually much more? As a refinement of his continuous paper strip, Hollerith decided to begin instead with separate cards on which clerks manually punched holes corresponding to certain chracteristics of the citizens.

Card the size of dollar bill

The card used for the 1890 census corresponded to the size of a dollar bill with punch positions occupying the whole surface.

One type of machine was used to punch the 240 spaces constituting the body of each card, and a second, known as the gang punch, punched several cards at once, for the geographic identification section. Once punched, the cards were read by placing them in a pin press, which contained a mercury cup beneath each position where the hole might occur in a card. A hinged lid was closed, carrying a spring-loaded pin or plunger corresponding to each mercury cup.

If a hole had been punched, the pin passed through it to make electrical contact with the mercury in the cup below. If there was no hole, the card held the pin back and no contact was made. Between 50 and 80 cards a minute could be passed through the pin press.

An electromagnetically controlled sorting slot separated selected cards. The sorter had a box containing 24 bins, each with a lid held closed by an electromagnetic latch working against a spring. When a hole was sensed, an electric current flowed that turned off the latch, allowing the spring to open the lid. The card was then dropped into the open bin by hand.

At the end of each day, the total on each of the 40 dials was recorded and the dial was set back to zero.

The machine was extremely reliable, although there were occasional mechanical failures. Recognizing the commercial value of his invention, Hollerith set up the Tabulating Machine Co. in 1896 and manufactured both machines and cards at its first plant in Washington, D.C.

Branching out

The results of the U.S. experience impressed the world, and it was not long before Hollerith's system was being used in Canada and Austria and being tried out in Italy, France and Germany. Hollerith even managed to get a contract with Russia for its first census, taken in 1897.

His equipment was used again for the 12th U.S. Census in 1900, this time on a rental basis. During the 1900 census, Hollerith developed an tabulating machine into which cards were fed automatically rather than by hand. Also during the 1900 census, Hollerith turned his attention to the statistics of agriculture, devising the first electric sorting machine.

In 1911, Hollerith's 15-year-old Tabulating Machine Co. merged with the International Time Recording Co., the Dayton Scale Co. and the Bundy Manufacturing Corp. to form the Computing-Tabulating-Recording Co. (CTR). CTR, a holding company, was renamed the International Business Machines Corp. in 1924.

Hollerith, who received his last patent in 1919, remained associated with CTR until 1921. Even in 1923, he wrote of plans to develop a tabulator, similar to those later in use. Unfortunately, illness did not allow Hollerith to realize his plans. He died in 1929 of a heart attack.

Atanasoff: The judge said he invented the computer

John Vincent Atanasoff, said by some to have directly inspired John Mauchly's work on the Eniac computer, was born in 1903, the son of a Bulgarian immigrant who had worked his way through Colgate University to become an electrical engineer.

In the early 1930s, Atanasoff taught at Iowa State College in Ames, Iowa, after earning his Ph.D. in theoretical physics from the University of Wisconsin. While teaching, Atanasoff found himself faced with the same problem that inspired other mathematicians and scientists to contemplate a method of automatic calculation: Most of the problems put to his students required the solution of linear algebraic equations with many variables.

'I commenced to go into torture'

With some knowledge of Charles Babbage's and Blaise Pascal's studies, Atanasoff began an extensive study of the possibilities of computing technology. "I commenced to go into torture," Atanasoff explained. "For the next two years, my life was hard. I thought and thought about this."

Finally, in a dramatic sequence, Atanasoff was inspired with the answers to his questions, according to his expert witness testimony in the case of *Honeywell, Inc.* v. *Sperry Rand Corp. & Illinois Scientific Developments, Inc.*

"One night in the winter of 1937, my whole body was in torment from trying to solve the problems of the machine," Atanasoff testified. "I got in my car and drove at high speeds for a long while so I could control my emotions."

Although Atanasoff usually drove in such a way "for a few miles," that night he claimed to have been "excessively tormented" to the point of driving 189 miles nonstop across Iowa, over the Mississippi River and into Illinois.

"I knew I had to quit," Atanasoff said, so he stopped at a tavern and ordered a drink. In the tavern, "things seemed to be good and cool and quiet," he recalled, and there his torment dissipated.

Four-part solution

The jumble of thoughts and inspirations that had tormented Atanasoff for two years suddenly crystallized into four definite solutions to the problem of electronic computing.

Atanasoff decided he would incorporate the following into an electronic digital computer: binary code, nonratcheting logic, serial calculation and regenerative memory.

There followed many months during which Atanasoff perfected the ideas he had conceived in the roadhouse in Illinois, including devising his previously nonexistent type of logic.

Atanasoff received an initial grant of $650 from the Iowa State Research Council, which bought him the part-time assistance of an engineering graduate student, Clifford Berry, as well as materials to build a "breadboard" model.

Atanasoff meets Mauchly

It was in December 1940 that Atanasoff met Mauchly at a meeting of the American Association for the Advancement of Science. Atanasoff told Mauchly about his computing machine and invited Mauchly to see it.

In June 1941, Mauchly spent five days as Atanasoff's house guest, during which time they apparently discussed and observed the Atanasoff-Berry Computer (ABC).

At the time of Mauchly's visit, Berry was working on a binary card punch and reader for input/output and slow memory. Later, the ABC was capable of solving up to 29 simultaneous equations with 29 variables.

Late in 1942, Atanasoff and Berry left Iowa State. Berry took a job with Consolidated Engineering in Pasadena, Calif., and Atanasoff accepted a research position with the Naval Ordnance Laboratory in Washington, D.C., where he eventually became the head of the Acoustics Division.

Atanasoff was disappointed that Iowa State College did not apply for a patent on his ABC as the college had promised, but he was well aware that such a patent would not make him financially independent, he said.

The Eniac patents case

It was the Eniac patents case that inspired District Court Judge Earl Larson to find in 1973 that it was Atanasoff who actually invented the concept of the automatic digital computer.

After that ruling, Mauchly maintained that the ABC was "just a crude little machine that wouldn't really do anything" and that Eniac was "a highly sophisticated and operational machine."

Furthermore, Mauchly reportedly commented, "[J. Presper] Eckert and I wish that the Sperry Rand people would have appealed this because it does leave us in a bad position because of the misunderstanding of the court."

Besides his inventing work, Atanasoff was a businessman whose firm, Ordnance Engineering Corp., was sold to Aerojet General Corp. in 1962. He holds approximately 30 patents.

The awards Atanasoff has received for his work in computing include the Order of Cyril and Methodius, First Class, Bulgaria's highest honor for scientists in 1970, and two honorary doctor of science degrees.

As for Clifford Berry, his scientific promise was not to be fully realized. He died in 1963, and his death was ruled a suicide.

After driving 189 miles nonstop through the night, John Atanasoff stopped in a tavern, ordered a drink and came up with the method to build the electronic digital computer. A prototype of the Atanasoff-Berry Computer was built in 1939.

The jumble of thoughts and inspirations that had tormented Atanasoff for two years suddenly crystallized into four definite solutions to the problem of electronic computing: binary code, nonratcheting logic, serial calculation and regenerative memory.

Mauchly and Eckert: They made Eniac electronic

It was a team like Rodgers and Hammerstein or Gilbert and Sullivan — a perfect blend of complementary talents that time after time produced compelling works for an appreciative audience of millions.

J. Presper Eckert and John Mauchly produced four classics: Eniac, EDVAC, BINAC and Univac I, and without question deeply influenced the development of the computer industry as we know it.

Both were already interested in the possibilities of automatic computation when World War II turned possibilities into urgent needs. In 1942, the Ballistic Research Laboratory of the U.S. Army Ordinance Department was assigned the job of recomputing firing and bombing tables for the springier ground of Africa and for proposed gun and projectile combinations, rockets, missiles and other strategic arms.

Manual computation of a single trajectory for a given set of conditions normally took military specialists several hours with a desk calculator. In a "crisis of calcuating," as Eckert called it, hundreds of operators were needed around the clock to develop the necessary ballistic tables.

Mauchly wrote a memorandum in 1942, based on discussions with Eckert, called "The Uses of High Speed Vacuum Tube Devices for Calculating," suggesting that his idea for a vacuum tube computer would fill the Army's bill.

The memo was misplaced and lay buried for almost a year before being resurrected by then-Lt. Herman H. Goldstine, an assistant professor of mathematics at the University of Michigan before joining the Ballistics Laboratory at Aberdeen Proving Grounds, Md.

At Goldstine's urging, Mauchly unearthed the original shorthand notes for the memo, had it reconstructed and sent immediately to Washington, D.C., for approval.

Begun in April 1943 — on Eckert's 24th birthday — Eniac was finished more than 200,000 man-hours later, three years after it was started. An enormous, clumsy piece of equipment by today's standards, Eniac weighed 30 tons and covered 1,500 square feet of floor space.

It contained more than 18,000 vacuum tubes, 500,000 joints soldered to connect all the circuits, 70,000 resistors, 10,000 capacitors and 6,000 switches. Eniac used 150 kilowatts of electricity, equal to about 200 horsepower.

With only two of its 40 panels containing mechanical relays, Eniac proved to be the breakthrough in speed that automatic computation was striving for. Completed only two years after Howard Aiken's IBM/Harvard Mark I, Eniac performed calculations 1,000 times faster than that relay machine.

Featuring the all-important concept of subroutines — now at the heart of all modern computers — Eniac also broke new ground in being electronic and containing stored program features.


John Mauchly

Installed at the Aberdeen Proving Ground in 1947, Eniac worked on problems of weather forecasting, wind tunnel design and the study of cosmic rays, in addition to ballistics tables. At 5,000 additions and 1,000 multiplications per second, Eniac in half a minute could solve a problem usually requiring 20 hours with a desk calculator.

Although built for the purposes of war, Eniac was not completed until 1946, a year after Japan surrendered. Nevertheless, it was used for the next 10 years. Its parts are now stored at the Smithsonian Institution in Washington, D.C., the Moore School of Electrical Engineering at the University of Pennsylvania, the U.S. Military Academy at West Point, the Los Alamos National Laboratory in Los Alamos, N.M., the University of Michigan and the Fort Carson Museum in Fort Carson, Colo.

In spite of its many advances, Eniac featured a rather overwhelming drawback — it was partly controlled by a combination of switches and a telephone switchboard-type "patch cord" arrange-

ment. To change a program, the operator had to disconnect wires and plug them into different locations, a task that usually took several hours.

While Eniac was a vast improvement over the speeds of the previously developed mechanical analyzers, it quickly became evident that its still cumbersome programming technique would negate the computer's inherent speed. Eckert and Mauchly started planning a machine that would store the program electronically in the same way it stored data.

The stored program machine, to be called the Electronic Discrete Variable Automatic Computer (EDVAC), would not be completed until 1951, and not by Eckert and Mauchly themselves.

New partner

While the pair worked on the concept, they were joined in 1945 by the brilliant Hungarian-born mathematician John von Neumann, who had already worked informally with the project team. In June 1945, von Neumann prepared an outline of data learned from Eckert and Mauchly called "First Draft of a Report on EDVAC," in which he described stored program computers. The document was published even though the material in it was classified information, according to Eckert.

Because the draft carried only von Neumann's name as author, he has generally been regarded as the originator of the stored program concept, although Eckert says it was he who originated the idea. This point is one of several in the history of computing that are clouded by ill feelings and controversy.

Even though they had formally left the Moore School in June, that summer they both gave several lectures there as part of a course entitled "The Theory and Techniques for Design of Electronic Digital Computers." "That course did more for computing than anything," Eckert says.

"We communicated more information then than anything else did. The students read like a 'Who's Who' of Computing," he adds.

Before the struggling Eckert-Mauchly Computer Corp. could finish Univac — because of delays at the National Bureau of Standards on the U.S. Bureau of the Census contract — it took on another project to gain more capital. The Binary Automatic Computer (BINAC), begun in 1947 for the Northrop Aircraft Co., was completed in 1949.

BINAC, the company's first operational, stored program, electronic digital computer, was cheaper and faster than Eniac or EDVAC and could handle magnetic tapes instead of punched cards.

After exhausting every effort to get support, Eckert and Mauchly sold their company to Remington-Rand Corp. in February 1950. Remington-Rand merged with Sperry Corp. in 1955 to form Sperry Rand.

In 1951, Eckert and Mauchly completed work on Univac I, the world's first commercially produced eletronic digital computer. The Census Bureau, with the Standards Bureau as its agent, was the first organization to order a computer.

Dedicated in June 1951, Univac I was first used to complete the 1950 census. It was the first commercial computer to use a compiler to translate program language into machine language.

The Department of Commerce retired the original Univac I in 1963 after more than 73,500 hours of operation. Parts of the machine are now on display in the Smithsonian Institution.

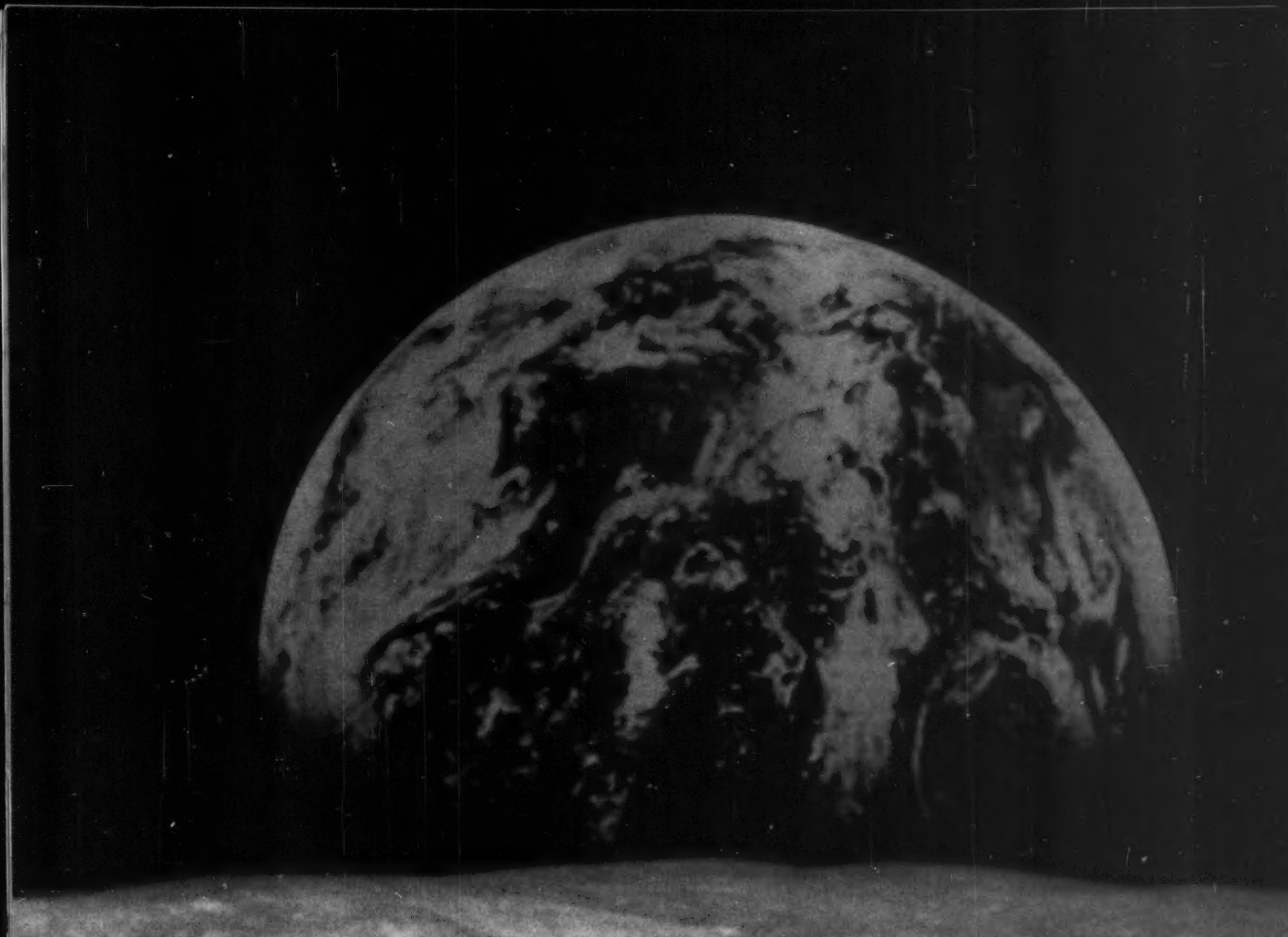
Post-Univac

After the completion of Univac I, both Eckert and Mauchly remained at Remington-Rand, Eckert as engineer and Mauchly involved in the logic design and software for Univac.

Eckert went on to do development work on the Livermore Automatic Research Computer, the first machine to feature multiprogramming and multiprocessing, and helped develop Univac III.

Eckert remains at Sperry Corp. to this day as vice-president and technical advisor. He lives in Gladwyne, Pa.

Mauchly died Jan. 8, 1980, after a long illness. He is survived by his wife, the former Kathleen McNulty, who was a programmer for Eniac.



John von Neumann: Mathematician, EDVAC designer — and salesman

BY NANCY STERN

John von Neumann was one of the most influential mathematicians and computing pioneers of this century. Among his technical contributions, he helped to formalize the logical design features of the EDVAC, the world's first electronic digital computer designed to incorporate stored-program capability.

But there was another dimension to von Neumann's influence, one that was at least as important as the technical side. He was able to bring together various groups of people capable of contributing to computer development and groups who could benefit from it.

Von Neumann's ability to legitimize the computer as a scientific tool to be used by academics was as significant as his specific contributions to the computing field.

Moreover, his efforts to disseminate information on computer development contributed to the transfer of technology to other spheres, as well as to the widespread applicability of computing devices.

Von Neumann was born in 1903 in Budapest, Hungary. He attended the University of Budapest, specializing first in chemical engineering and then in mathematics. He received a Ph.D. in mathematics from Budapest at the age of 22 and, in 1927, having already published several papers on algebra, set theory and quantum mechanics, became a *Privatdozent* at the University of Berlin. In 1930, Princeton University invited him to be a visting lecturer, an appointment he held for three years. In 1933, he received a permanent position at Princeton's newly created Institute for Advanced Study.

Von Neumann's reputation as one of the world's most distinguished mathematicians was clearly established by 1940. A highly proficient and prolific scholar, he had already published important papers in such fields as ergodic theory, operator theory and formal logic. Moreover, like David Hilbert and Richard Courant before him, von Neumann was instrumental in promoting the discipline of mathematical physics as an appropriate subject for pure mathematicians.

He was well known for work on the logical and mathematical foundations of quantum theory and on problems in statistical mechanics.

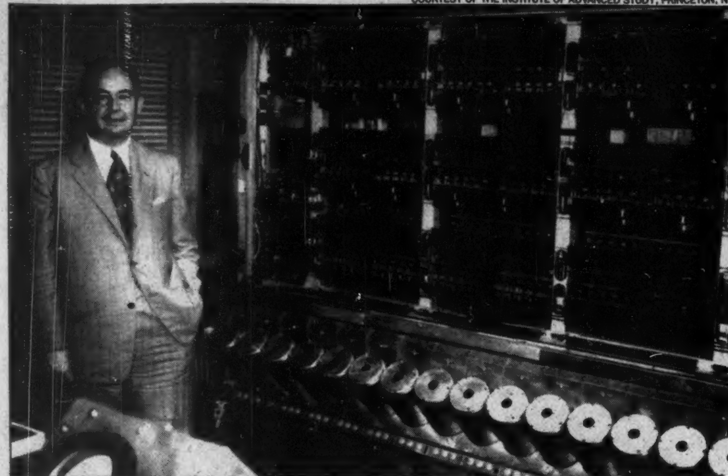
'Not a purist'

As Stanislaw Ulam, a close friend and colleague of von Neumann at Los Alamos Scientific Laboratory, stated: "He was not entirely what one might call a mathematician's mathematician.

Purists objected to his interests outside of mathematics when very early he leaned toward applications of mathematics or when he wrote as a young man about problems in quantum theory."

With the onset of World War II, von Neumann's knowledge of mathematical physics proved of great value to his adopted country. P. R. Halmos, a fellow mathematician, wrote, "Whether the war made him into an applied mathematician or his interest in applied mathematics made him invaluable to the war effort, in either case he was much in demand as a consultant and adviser to the armed forces and to the civilian agencies concerned with the problems of war."

COURTESY OF THE INSTITUTE OF ADVANCED STUDY, PRINCETON, N.J.



Computer pioneer and mathematician John von Neumann stands with the Institute of Advanced Studies Computer, completed in 1952. A personable, ambitious man, von Neumann contributed to technological breakthroughs such as the stored-program concept and helped legitimize the computer as a scientific tool.

His contributions to supersonic wind tunnel development and solutions to nonlinear systems of equations and implosion were instrumental in advancing the Allied cause.

During and after the war, his main professional interest shifted from pure to applied mathematics, a reorientation that lasted until his death in 1957. "The year 1940 was just about the halfway point of von Neumann's scientific life, and his publications show a discontinuous break then," Halmos has pointed out. "Until then he was a topflight pure mathematician who understood physics; after that he was an applied mathematician who remembered his pure work." In all, his collected works, which include papers on both pure and applied mathematics, fill six volumes.

Wartime consultant

During the war, von Neumann was a consultant to various government agencies, including the Army's Ballistics Research Laboratory, the Navy Bureau of Ordnance and the Los Alamos Scientific Laboratory. In addition to making significant scientific contributions to these organizations, von Neumann was instrumental in providing direction to their research.

Von Neumann's role during the war provided him with a status and influence achieved by very few mathematicians. Pure mathematics was at that time usually viewed as too abstract for most practical applications. Von Neumann made every effort to establish the social utility of the sciences in general and one specific concern was to legitimize the role of mathematics in particular as a practical and useful science. Ulam, in an obituary written for the American Mathematical Society in 1958, the year after von Neumann's death, pointed to this aspect of von Neumann's interest:

"Perhaps his main desire and one of his strongest motivations was to help re-establish the role of mathematics on a conceptual level in theoretical physics. The drifting apart of theoretical mathematical research and of the mainstream of ideas in theoretical physics since the end of the First World War is undeniable. Von Neumann often expressed concern that mathematics might not keep abreast of the exponential increase of problems and ideas in physical sciences."

By 1944, von Neumann had a reputation as a distinguished mathematician and as a scientific leader with vast influence in governmental and academic circles. His relationship with government agencies put him in a position to make policy recommendations, as well as technical and administrative ones, regarding the scientific resources of the nation. Moreover, he seemed to value this sense of power. Ulam remarked that "von Neumann seemed to admire generals and admirals and got along well with them" — a characteristic Ulam attributed to von Neumann's "admiration for people who had power."

It would be difficult to determine precisely when von Neumann first became interested in digital computers, but as a result of his war work on implosion, he was cognizant of the critical need for advanced methods of digital computation. As Herman Goldstine stated in his book *The Computer From Pascal to von Neumann*, von Neumann attempted to show, while at Los Alamos, "the theoretical people how to model their phenomena mathematically and then to solve the resulting equations numerically. A punched-card laboratory was set up to handle the implosion problem."

Sought alternative

But punch-card equipment was very slow and inefficient. Von Neumann became actively interested in more advanced computational equipment. His work on implosion at Los Alamos required solutions of systems of nonlinear equations in fluid dynamics. Since existing manual methods for solving these problems were extremely time-consuming, he sought an alternative. Von Neumann sensed that digital computers might prove useful in this regard.

Though von Neumann's interest in instruments for scientific calculations was shared by some innovators in the computing field, it was decidedly uncharacteristic of pure mathematicians in general. Numerical methods can give only approximate solutions of differential equations. For pure mathematicians who tend to view theory as superior to empiricism, approximations were lacking in rigor and therefore totally unacceptable in theoretical work.

Thornton Fry of Bell Laboratories and the National Defense Research Committee, in his article "Industrial Mathematics," summed up the typical attitude of industrial engineers toward pure mathematicians in the early 1940s: "Just now an attitude more commonly met . . . is one of amazed pride in pointing to

some employee who isn't like most mathematicians; he gives you an answer you can use and isn't afraid of approximations."

Von Neumann shared with applied mathematicians, particularly those engaged in war work, the realization that approximations serve a useful purpose in solving practical problems and can frequently facilitate the solution of theoretical problems.

Hence his enthusiasm for computational equipment went further than his effort to minimize the labor required for solving his own problems; he hoped to demonstrate its value to science. In fact, one of von Neumann's major contributions during and after the war was his legitimization of applied mathematics as a scholarly field.

In August 1944, von Neumann learned about the U.S.'s first electronic digital computer, the Eniac, being developed at the Moore School of Electrical Engineering of the University of Pennsylvania under the direction of J. Presper Eckert Jr. and John William Mauchly. Von Neumann learned of the machine at a Scientific Advisory Committee meeting at the Ballistics Research Laboratory in Aberdeen, Md. He met Herman Goldstine, the laboratory's liaison on the Eniac project.

As Goldstine later recalled: "I was waiting for a train to Pennsylvania on the railroad platform in Aberdeen when along came von Neumann. Prior to that time, I had never met this great mathematician, but I knew much about him, of course, and had heard him lecture on several occasions. It was therefore with considerable temerity that I approached this world-famous figure, introduced myself and started talking.

"Fortunately for me, von Neumann was a warm, friendly person who did his best to make people feel relaxed in his presence. The conversation soon turned to my work. When it became clear to von Neumann that I was concerned with the development of an electronic computer capable of 333 multiplications per second, the whole atmosphere of our conversation changed from one of relaxed good humor to one more like the oral examination of the doctor's degree in mathematics."

Beginning in September 1944, von Neumann took time from his Los Alamos work to make periodic visits to the Moore School to learn more about the Eniac and to make technical recommendations on the Edvac, the school's second electronic computer. Since the design of the Eniac had been frozen in June 1944, von Neumann had little to do with the actual technological features of that machine. He did, however, suggest that the Los Alamos group working on the hydrogen bomb could use the Eniac for its complex calculations. It was largely as a result of his influence that the first application, or test, of the Eniac was for Los Alamos.

Von Neumann's ability to legitimize the computer as a scientific tool was as significant as his contributions to the computing field.

Von Neumann's interaction with the Moore School had two immediate effects. First, it legitimized and justified the project to other government agencies such as the National Defense Research Committee. Despite the substantial technical accomplishments already achieved by the Eniac, von Neumann's presence was an effective method for gaining added recognition.

Second, it was soon after von Neumann became interested in the Eniac that the Moore School received a contract for the development of the new and more powerful EDVAC, which was to have stored-program capability. Von Neumann contributed to the logical design theory for the EDVAC and stored-program computers in general.

The Eniac progress report on Dec. 31, 1943 emphatically stated that, for the sake of expediency, the project staff elected to omit

any automatic programming capability: "No attempt has been made to make provision for setting up a problem automatically. This is for the sake of simplicity and because it is anticipated that the Eniac will be used primarily for problems of a type in which one setup will be used many times before another problem is placed on the machine."

In January 1944, when the Moore School staff began to consider the development of a device more comprehensive than the Eniac, Eckert wrote a one-page disclosure broadly indicating a stored-program machine: "If multiple shaft systems are used, a great increase in the available facilities for allowing automatic programming of the facilities and processes may be involved. This programming may be of the temporary type set up on alloy disks or of the permanent type of etched disks."

Thus, months before von Neumann knew of the Moore School work, the stored-program concept had been conceived, if not developed. With von Neumann's assistance, however, this concept was carefully structured and developed in the period between 1944 and 1945.

First draft on EDVAC

In June 1945, von Neumann prepared a report called "First Draft of a Report on the EDVAC," a paper on stored-program computers, which, as its title implies, was intended as a preliminary and informal document. Goldstine distributed the 101-page report to members of the Moore School staff and also to interested scientists not associated with the EDVAC.

The report was the first widely circulated document on electronic digital computers. The exact number of copies distributed at the time is not known; at least 32 people were on the original mailing list, but many others received copies later. The report consisted of a series of definitions of concepts relating to logical control and stored programming.

The contents of these sections formed the basis for computer and stored-programming design in the late 1940s.

The draft report also included a section emphasizing the similarity between computer processing and the activities of the human nervous system, a topic that was one of von Neumann's major interests.

Since the draft report bore von Neumann's name as sole author, the stored-program concept was thought by computer professionals, as well as by many historians, to have originated with him. As a result, most studies have credited him with the origin of this concept, to the exclusion of all other participants.

In *The Computer From Pascal to von Neumann*, Goldstine has supported the claim that von Neumann was primarily, if not exclusively, responsible for this concept. Early in the book, he flatly states: "Von Neumann developed the revolutionary concepts of the stored program." Later, Goldstine says that von Neumann's draft report "represents a masterful analysis and synthesis by him of all the thinking that had gone into the EDVAC from the fall of 1944 through the spring of 1945. Not everything in there is his, but the crucial parts are."

Arthur W. Burks, a mathematician who worked as an engineer on the Eniac and EDVAC projects, supports the view that the ideas in the draft report were primarily von Neumann's: "Goldstine brought von Neumann in as a consultant, and we all participated in discussions of the logical design of such a machine. . . . Von Neumann then worked out in considerable detail the logical design of this computer. The result appeared in his 'First Draft of a Report on the EDVAC,' which was never published."

'A historical error'

In 1976, Nicholas Metropolis, the Los Alamos scientist who also had worked closely with von Neumann, collaborated with Jack Worlton on an article that provided a different view of the derivation of the ideas explicated in the draft report: "Another point concerning the stored-program history which needs clarification is the unwarranted assumption that J. von Neumann alone deserves the credit for the stored-program concept. . . . It is clear that the stored-program concept predates von Neumann's participation in the EDVAC design.

"That von Neumann is often given credit for this fundamental concept is likely due to the fact that he wrote a preliminary report which summarized the earlier work on the EDVAC design, including the stored-program concept. Von Neumann contributed significantly to the development of this concept, but to credit him with its invention is a historical error."

....

"Computers are often a disaster in social science research. If you multiply data at an enormous clip, you have very few ways of analyzing it. A famous study a few years ago came up with the most meaningless results you could imagine. Why? They threw every variable into the computer and cross-tabulated it. Fifty thousand correlations overwhelmed them — they had no sense of what was going on."

S. M. MILLER
Boston University

Motorola Introduces Peaceful Coexistence.

Harry Huskey, a Moore School engineer himself, provides a similar retrospective view: "After von Neumann's introduction to the Eniac, there were a number of meetings between him and the Eniac staff discussing various ideas and proposals. As a joint effort, this group developed the concept of a stored program. The results of this activity were written up by von Neumann in a 'draft' report which, not being in final publication form, did not give due credit to others for the development of the ideas. However, the report was reproduced in this draft form and circulated quite widely. As a result, von Neumann has generally received credit for this idea."

In short, von Neumann's report on the EDVAC was the first document to provide a logical framework for stored-program computers and for programming concepts. His attention to providing a written record and his development of automatic controls that had been conceived but not yet designed by the Moore School staff, were factors leading others to credit him with priority.

Von Neumann's interest in computers as tools for the mathematician led him, in the early part of 1945, to seek support for his own computer project. The manner in which he sought and achieved his objective sheds light on his entrepreneurial and innovative abilities.

IAS computer

During the war, von Neumann was still a member of the Institute for Advanced Study (IAS), an institution noted for its pure research and its "ivory tower" attitude toward applied work. Even in physics, a major subject field at IAS, the emphasis was theoretical rather than experimental. IAS had limited laboratory facilities, prompting von Neumann's friend and colleague, Norbert Wiener, to write him on March 24, 1945: "You are going to run into a situation where you will need a lab at your fingertips, and labs don't grow in ivory towers . . . Harrison wants to find out if you would come to MIT."

Ideal vehicle

Since computers were socially useful machines and von Neumann had already demonstrated their mathematical/logical structure, the computing field represented an ideal discipline in which mathematicians could firmly establish their social value. Mathematicians who engaged in computer design would stand to benefit from the government-funded research that was to become a post-war norm.

In conclusion, von Neumann helped to formalize the logical design features of the EDVAC, the world's first electronic digital computer designed to incorporate stored-program capability. He also undertook a computer project at IAS, which, when completed, served as a model for numerous other academic and research institutions.

But another dimension of von Neumann's influence was at least as important. He was able to convince a very dubious mathematical community that the electronic digital computer was a useful scientific instrument that could be developed at academic institutions. He brought together those who were capable of contributing to computer development and those who could benefit from it.

Despite these and later numerous contributions to computing and mathematics, Von Neumann's work in some areas depended, in varying degrees, on the efforts of others. The stored-program concept is one important example.

Stern is a professor in the Department of Administrative Computer Systems at Hofstra University, Hempstead, N.Y. She is a historian with a background in computer science and has written several textbooks on programming languages. Her book From Eniac to Univac *is published by Digital Press.*

This article was published in Computerworld *on Feb. 1, 1982.*

Watson Sr.: The man who painted the town Blue

Rarely has one man had such an influence over a business as did Thomas J. Watson Sr., for 40 years the inspiration, leader and patriarch of IBM.

IBM owes its success largely to the tastes, beliefs and ideals of Watson, who almost single-handedly elevated his company to a level rivaling that of organized religion.

Indeed, IBM in its early days was infused with a decidedly religious tone, featuring fervent revival meeting-type conventions, group singing, inspirational slogans and the ever-present, benevolent but unpredictable father figure of Watson, overseeing his carefully groomed universe.

Watson became so influential, in fact, that he not only enjoyed close relationships with three American presidents but also entertained the most important political and social figures in the world.

How did he do it? How did a backwoods peddler from Painted Post, N.Y., build such an empire?

The answer lies in Watson's strong personality, high ideals, ability to learn from others and from his own mistakes. On a road that was not always smooth, Watson repeatedly turned the most discouraging circumstances into opportunities through his ingenuity and remarkably strong force of will.

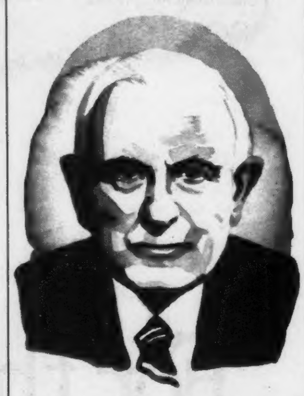
The story begins simply enough, with the birth of Thomas John Wasson on Feb. 17, 1874, to a brawny, tough lumberjack and his wife.

Young Watson's childhood was largely uneventful. Neither studious nor athletic, he reportedly was lively and assertive, with a quick temper that was to plague him all his life. He spent much time helping to run the family farm, training horses, harvesting and chopping trees.

As his own son, Thomas J. Watson Jr., would later say, "He grew up in an ordinary but happy home where the means, and perhaps the wants, were modest and the moral environment strict. The important values, as he learned them, were to do every job well, to treat all people with dignity and respect, to appear neatly dressed, to be clean and forthright, to be eternally optimistic and, above all, loyal."

Not only would Watson retain those values throughout his entire life, but he would see them successfully instilled in thousands of his own workers during the nearly half a century that he held the corporate reins at IBM.

His career began, after a year at the Miller School of Commerce in Elmira, N.Y., with the study of accounting and business, when Watson landed a job as a bookkeeper in a meat market. The year was 1892, and his salary was six dollars a week. Although the money was



considered good, the challenge was less than compelling. "I couldn't sit on a high stool and keep books all my life," he commented.

Fate was to come to Tom Watson's rescue in the person of George Cornwell, a traveling salesman who dealt in pianos, organs and sewing machines. Cornwell offered Watson a job as his assistant at $10 a week, provided he could supply his own horses to pull the wagon.

When Cornwell left the company, Watson got his territory, "and that was the most responsible job I've ever had from that day to this," Watson recalled many years later. "And I felt more important in it than any position I've ever held, because I was the general manager, sales manager, accountant, deliveryman — I was the whole organization."

By 1894, Watson's father, whose own farming enterprise had been plagued with bad luck and natural disaster, counseled his only son to leave Painted Post. While he might make a living there, it was no place to spend a lifetime, the father felt.

So, on to Buffalo went Tom. There he found a short-lived job selling sewing machines, followed by a job with the Buffalo Building and Loan Association selling stock to the public to finance the company's growth.

While arranging a transaction

for Buffalo Building and Loan at the office of the National Cash Register Co. (NCR), Watson applied for a position as salesman. It took several attempts, but finally Watson convinced manager John J. Range to hire him in October 1895.

Watson at first had absolutely no luck selling cash registers. After Watson had worked 10 days without a sale, Range lit into the young man with a harsh speech designed to open his eyes to the realities of selling.

Open his eyes it did, and just when Watson had decided he would quit his job at the end of Range's speech, the tone of the tirade changed completely, and Range suggested the two of them go out together and try again to sell some machines.

Eventually Watson was promoted to manager in Rochester, N.Y. "The reason I was given that territory was that nobody else would take it," he claimed. But Watson did take it, and from there began his dramatic climb to the heights of the business world.

In 1903, Watson's reputation was solid enough so that he was chosen over 400 other salesmen at NCR to head a new, secret subsidiary.

Selected partly because of his very obscurity, Watson was now slated to mastermind the feat of gaining control of all the secondhand cash register business in the country. No one was to know of its connection with NCR.

Seeing the enterprise as a personal opportunity, Watson took on the assignment with enthusiasm and soon proved his talents as an executive. Watson established stores next to successful competitors, copied their successes and discarded their unsuccessful methods, undersold them, hired their salesmen away from them and eventually put them out of business.

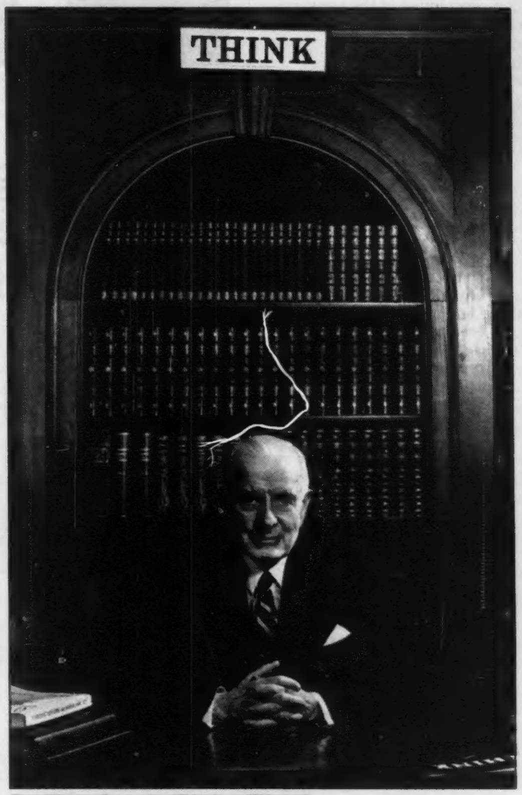
It is said that Watson always regretted his experiences during those years and rarely mentioned them. On the other hand, his tactics were as fair as they could be under the circumstances. He always treated his competitors with consideration and offered generous settlements, often even hiring the bereft businessman as well as buying him out.

By 1907, the secret was out, and NCR announced that Watson was in charge of the company's secondhand business. Now the third most powerful man at NCR, Watson was 33 years old.

In the midst of Watson's material good fortune, he met the woman who would stand by him through thick and thin, the beautiful, well-bred Jeannette Kittredge, daughter of a successful Ohio businessman.

Watson was 38 and Jeannette 29 when they met in the spring of 1912. A year later they were married. As a wedding gift, NCR President John Patterson presented them with a summer house especially built near his own summer home. Less than six months later, Patterson fired Watson.

Watson was one in a long line of distinguished men whom Patterson fired. The president was known to cultivate strong, intelligent advisors until they reached a point where he felt they were overstepping their bounds. The end was swift and often severe, as in the case of one executive who returned from a trip to find his desk and chair in flames outside the factory.



Tom Watson Sr. made "Think" an IBM word.

Watson's end at NCR was not quite as dramatic and ended a period of months during which the two men's relationship had grown more difficult. Patterson reportedly grew increasingly envious of Watson's popularity with the sales force, but the final catalyst was a disagreement over company policy.

Not only did Watson disagree with one of Patterson's proposed policies, but he disagreed with Patterson in front of other company executives. Suddenly, Watson's access to Patterson was reduced to almost nothing, and within weeks Watson got the word that he was no longer wanted.

Three months short of 40 and two months short of fatherhood, Watson was without a job. As he left his NCR office for the last time, he reportedly said, "I've helped build all but one of those buildings. Now I am going to build a business bigger than John H. Patterson has."

Deluged with job offers from successful companies wanting to pay him a large salary for his proven abilities, Watson instead wanted to assume leadership of a company, work only for a commission and share in the firm's profits.

Watson found the perfect environment for his talents in the newly formed Computing-Tabulating-Recording Co. (CTR), the result of the merging of Herman Hollerith's Tabulating Machine Co., International Time Recording Co., the Dayton Scale Co. and Bundy Manufacturing Co. Watson started at CTR in 1914 with a yearly salary of $25,000 and an option on 1,220 shares of stock. After three months, he was president — his principal goal was to bring CTR to a position of technical advancement in the face of a growing need for automatic calculation.

With Hollerith losing interest in technical innovation as he felt company control slip from is hands, Watson recognized the need to forge ahead with research and development, especially in light of superior equipment being produced by inventor James Powers' Powers Accounting Co.

Powers reportedly had a statistical machine that printed results as opposed to Hollerith's hand-posting, featured an electrical punch instead of Hollerith's hand-operated one and a horizontal sorter in place of the inconvenient vertical sorter Hollerith had designed for crowded railroad offices. Worse yet, Powers rented machines for $100 per month while CTR asked $150.

In October 1914, Watson established a research department under one of Hollerith's men, followed two years later by a laboratory. It was there that engineer Clair Lake invented a superior printer-lister that saved Tabulating Machine Co. from ruin.

Salesmen cheered

At the first CTR combined sales meeting in 1919, Watson dramatically unveiled the machine and, with the flick of a switch, the device began printing results as cards flowed through it. Salesmen stood up in their chairs and cheered, feeling they were at the gateway to commercial success at last.

And they were. The Tabulating Machine Co. was to revolutionize its industry in a move from accounting to data processing and global communications that put the company on the forefront of a technology that had only been dreamed of.

Six years after Watson joined the company, CTR's gross income had more than tripled from $4 million to almost $14 million. The year 1920 saw the firm doing more business than it had done in the previous four combined.

In 1924, Watson became chief executive office of the company and its name became International Business Machines Corp. — "International" to suggest the projected scope of its influence and "Business Machines" to indicate the diversity of its interests.

Watson was now completely in charge and began a campaign to impress his distinctive personality on the organization. Watson felt that his workers should exhibit loyalty, unity, idealism, enthusiasm and spiritual commitment. "You have to put your heart in the business and the busi-

ness in your heart," he said.

The extreme loyalty Watson extracted from his men became known as the "family spirit," and if anyone felt a bit too put upon by the emotional demands of a paternalistic chief executive officer, out the door he went.

Those who left walked away from a religiously nonunion company that offered its employees a country club, educational programs and gala celebrations that stemmed from Watson's love for ceremony, luxury and impressive outward appearances.

Victor, not victim

During the Depression of the 1930s, Watson was victor instead of victim. Although the office equipment industry suffered a 50% decline at that time, IBM held steady.

Instead of laying off large numbers of workers, he continued his building program and churned out more equipment to be stored for future use.

In 1935, when the newly created Social Security system cast about for someone to do its bookkeeping, it was IBM's huge surplus that guaranteed it the contract.

"World Peace Through World Trade" became IBM's slogan. As president of the International Chamber of Commerce, Watson became so well-known through his speechmaking that many foreign subsidiaries were named Watson Business Machines.

When World War II hostilities began in Europe, Watson put all the IBM facilities at the government's disposal. Besides performing accounting tasks arising from the war, IBM factories actually produced rifles as well as parts for aircraft engines. For his cooperation with government objectives, Watson received the Medal of Merit.

It was during the war that IBM entered the computer business, largely in response to the innovative ideas and financial needs of the inventor Howard Aiken at Harvard University.

Like previous computer pioneers, Aiken was concerned with the vast amounts of calculations used by science, technology and government.

After reading the original works of Charles Babbage concerning his theoretical Analytical Engine, Aiken wondered whether existing calculators could be combined into one super calculating machine.

Specifically, Aiken wondered about IBM's highly successful 601 Multipliers, but soon concluded that any such project would have to start from the ground up as opposed to resulting from the combination of several existing machines.

Approaching IBM's extremely respected inventor James Bryce, Aiken broached the possibility of such a project. Upon Bryce's presentation of the idea to Watson, whose faith in science and technology was boundless, $500,000 was made available for development work.

The war threatened to stop the project before it began, but when the U.S. Navy, in which Aiken was a lieutenant, realized the value of such a device, Aiken was released to complete the work. IBM assigned an engineering team led by Lake to help Aiken, and the project was under way.

Five years later, in 1944, the Automatic Sequence Controlled Calculator — familiarly known as the Mark I — was unveiled. Measuring 51 feet long and eight feet high, the Mark I contained about 800,000 parts and offered 60 registers for constants, 72 storage registers for addition, a central multiplication and division unit and could compute elementary transcendental functions such as logarithms and sines. It contained more than 500 miles of wire.

The extreme loyalty Watson extracted from his men became known as the "family spirit," and if anyone felt a bit too put upon by the emotional demands of a paternalistic chief executive officer, out the door he went.

The device could handle 23-decimal numbers and perform additions in 0.3 seconds. One and a half minutes were needed to determine a logarithm to 20 decimal places.

Thinking of his accomplishment as "Babbage's dream come true," which it certainly was, Aiken made an unfortunate misjudgment in taking full credit for its development. On the eve of the presentation ceremony, Aiken is said to have introduced the Mark I to the press without acknowledging Watson's and IBM's part in its development.

As a man who enjoyed getting the credit due him, Watson was enraged. "I'm just sick about the whole thing," he reportedly said. And to Aiken he stormed, "You can't put IBM on as a postscript. I think about IBM just as you Harvard fellows do about your university."

In a bid for revenge and an attempt to eclipse the Mark I, Watson ordered his engineers to come up with a stunning machine. Before they could do that, however, the first fully operational electronic computer was developed at the University of Pennsylvania in 1946.

Eniac

The Eniac machine was revolutionary, featuring speeds and flexibility far beyond those of the previous electromechanical devices. IBM rose to the challenge and in 1948 introduced the Selective Sequence Electronic Calculator (SSEC).

The Korean War and the competition, principally from Remington-Rand's Univac computer — delivered to the Census Bureau in 1951 — drove IBM to produce its Model 701, a scientific computer 25 times faster than the SSEC.

Shortly thereafter, IBM offered the 702, 704 and 705 models, which were so popular that competition began to fall away and the firm was on its way to becoming the leader in the computer industry.

In 1952, Thomas J. Watson Jr. became IBM's president and one week later, the government filed antitrust charges against the company. After three years of negotiations, Tom Jr. — much against his father's desires — signed a consent decree for the Justice Department.

A bit reluctantly, but recognizing the leadership consistently shown by Tom Jr., his father, on May 8, 1956, gave over the position of chief executive officer to his son. On June 19, just over a month later, Tom Watson Sr. died of a heart attack at 82.

In the 39 years between 1914 and 1953, IBM had seen assets increase by a factor of 24, employees by 34 and data processing business by 316.

Development expenditures had increased more than 500 times, manufacturing space had mushroomed and the educational program that began with impromptu talks had evolved into an annual program costing $50 million.

"Our greatest assets are men," Watson had always said. And of him, when he died, his minister said, "Integrity was the root of his character."

Gordon Bell helped set the standard for interactive computing.

A walk through The Computer Museum with Gordon Bell

The Computer Museum houses the world's largest collection of computer industry artifacts. C. Gordon Bell helped found The Computer Museum at Digital Equipment Corp., prompted by his deep involvement in the computer industry and a fear that all the interesting artifacts would be destroyed. The museum flourishes under the directorship of his wife, Gwen.

At DEC, Bell engineered the PDP-5, 8 and 11 and helped set the standard for interactive computing. He returned to DEC in 1972, where he helped design the first VAX and ushered in a new generation of minis.

In 1983, Bell founded Encore Computer Corp. with Kenneth Fisher and Henry Burkhardt. This year, Bell left Encore and became assistant director of computing and information sciences and engineering directorate at the National Science Foundation in Washington, D.C.

Bell gave Associate Features Editor Amy Sommerfeld Fiore a guided tour of the museum, giving his own comments on the exhibits along the way. This article originally appeared on Oct. 14, 1985, in Computerworld.

The Computer Museum occupies a spacious converted warehouse on Boston's waterfront, facing a preserved wooden schooner and a series of glass and steel skyscrapers. The blending of old and new in the cityscape serves as a perfect backdrop to the museum, which contains both the relics of a machine age gone by and examples of technologies still under development.

BELL: In a way, The Computer Museum is just like a computer. We had a prototype to test whether it was a good idea and what the clientele would be. Only DEC employees and customers visited the museum when it first opened.

The Museum started up at the DEC facility in Marlboro [Mass.] in September 1979. It was totally DEC-sponsored, not public, although three-quarters of the artifacts were made by other companies. A lot of time was spent debugging what to show about the machines and what to say about them, namely: What's the achievement? Why is it here?

Then we solicited "customers," and in June '82 went public with a board of directors. We solicited members and became, in effect, a production model. The second production model is The Computer Museum here at Museum Wharf.

The goal of the museum as I saw it was to collect the first object of a given class, the last object of a given class and then the important ones — the classics. The fun is trying to find out: When is something going to be classic? When is something going to be the first one? I always tried to err on the side of collecting more — ones

that I thought were really going to be important.

At the entrance to The Computer Museum stands Whirlwind, an experimental computer started in 1945 at MIT that eventually yielded the first core memory. Only one model of this 16-bit computer was ever produced; it operated from 1950 to 1959.

BELL: Whirlwind was the first real-time and control machine. It's here in part because it was the origin of the machines that came out of the New England region. It's a classic mini — as big as a house — and it has lots of firsts, including parallelism and real-time, interactive I/O.

Whirlwind was a controversial project because the machine took longer than they thought it was going to take to build, and they spent quite a lot of money doing it. But once it was up and people started using it, then everyone began to see the benefits of having a fast machine like this and what it could do compared with the traditional [John] von Neumann-style calculating machines of the time.

MIT conceived Whirlwind as a simulator for aircraft stability. That was one of the reasons it ended up with a short word length. Machines that were being built around this time tended to have 36- to 40-bit word lengths, according to von Neumann's guidelines. Whirlwind's engineers built a 16-bit computer because that was all the precision they needed. All the other machines were serial and slow, while this one was parallel and very fast.

One feature of experimental machines is that you never know exactly what you're going to get out of them. The MIT/Forrester patent for core memory came out of this project. The standard Williams tube memory in use at the time was so unreliable that the Whirlwind designers said, "We've got to have a new memory." Core memory was first tested on the Memory Test Computer [MTC], which [DEC President] Ken Olsen engineered. The MTC ran for about a month. The memory operated so well that the engineers just took it right out and put it on Whirlwind.

One hundred or 200 years from now, I want people to come and say, 'Gosh, I'm glad they saved all that stuff.'

Around the corner sit several large pieces of equipment that together make up the U.S. Air Force's AN/FS Q-7, developed by Jay Forrester and Robert Everett of MIT's Lincoln Laboratory. Installed in 1958 and decommissioned in 1983, the 32-bit Q-7 ran longer than any other computer, and was the first to serve 100 simultaneous users.

BELL: Whirlwind also ended up being the prototype for the Semi-Automatic Ground Environmental [Sage] air defense system computer, called Whirlwind 2. Later, IBM built it under the name AN/FS Q-7. MIT helped design the architecture and the circuits, and then IBM built these massive vacuum-tube machines. This was a 32-bit computer, designed to do everything Whirlwind could do and more.

It was a lovely machine because it had two 16-bit words that could be operated on in parallel. Each pair used 55,000 vacuum tubes and took 150,000W of power. The machine you see here in the museum was decommissioned only two years ago, in February 1983, and still ran at a phenomenal 99.95% uptime because of careful design and an absolutely controlled environment.

Notice the way it's built — a constant stream of air blows on each tube. Every tube is running at the same temperature. In addition, the users did something called "marginal checking," which meant they varied the voltages up and down to detect whether a tube was going to fail. By the time this machine was built, its designers really understood how to build very high-reliability computers.

On a museum field trip, we saw the AN/FS Q-7 before it was decommissioned. People operated the computer from this console of lights and switches. Today you can't see what's happening on a computer, but in the early days of computers there was a light on every bit.

You flipped switches to compute data, and you could see everything that was happening inside the machine. If the machine stopped or you wanted to run it slowly, clock by clock, you could see the whole state exactly.

I have programmed in machine language, bit by bit. In fact, until you get that first level of software on machines, you have to operate all machines bit by bit.

Core Memory Unit 2 from the AN/FS Q-7 stands 6 feet tall. It was considered a very fast memory. Any word in the Q-7's core memory could be accessed in 6 msec.

BELL: This refrigerator-size cabinet holds half of an arithmetic unit. This memory was one of IBM's contributions to the project. It stored only 4K by 32 bits — 131,000 bits, or one half of today's 256K-byte chip, which as you know is a very small fraction of the size. Later, they had a 64K-byte version, but this was really quite a small memory. That's why they needed all the drum units, which were used to swap programs with core. To show you the scale, each of these large drum units equals roughly one small floppy — about 256K bytes.

Getting rid of all the poor memories and switching over to core was a major transition. It occurred in the late '50s, even though the core was first operational in '53. It took that long to get core into other machines.

Cores hit the market simultaneously with transistor circuits, and that occurred almost precisely in 1960 — the beginning of the second generation of computing.

The year 1960 was a wonderful year, when a tremendous number of classic machines came out. Many were transistorized, and they all had core memories. That year was the beginning of serious computing.

The Univac I helped predict the results on presidential election night, 1952.

Reliable machines, relatively inexpensive, fast machines and good memories.

That's what really made computing start to grow exponentially.

For many Americans, computers in the 1950s were synonymous with Univac. "That marvelous electronic brain" was first introduced to the general public by CBS newscaster Walter Cronkite during the 1952 presidential elections.

BELL: This is the Univac I that the Eckert and Mauchly company built. It really was the first commercial computer. When I say "first," I have to be careful, particularly saying the "first commercial." There were a couple of computers already operating in England, such as the Leo computer, but it's very hard right now to pin down when those were actually shipped.

When you say "first" you're asking, "When was it that a customer had it in his site, actually using it?" You have to read all the fine print.

There were 46 of them, which at the time was massive volume. The price was about $930,000 initially, and it declined over time.

The way to really see machines is to see how they were used at that time. The films the museum preserves and shows are really important for just this reason. They show, for example, what key punching was really like or how Eniac was used. Here's the first film on programming, and the first AI film and one on the introduction of Fortran. We also have a film made for the museum just when the last IBM Stretch was taken out of service.

The museum has a videotape of Walter Cronkite talking about the first time Univac predicted the 1952 election results. During the election, there was concurrent reporting about the election and the computer's handling of it. I remember there was a very different attitude than you see today, when everyone says, "Computers have really fouled up elections. Computers shouldn't be allowed to predict results because that will influence the voters," and so on.

The response then was amazement, absolute amazement: "How can this thing know what's going to happen after only a few hours?" The film the museum has of Cronkite's announcing doesn't quite match the amazement of the moment.

This machine was literally telling us what was going to happen. In fact, it seemed so eerie that the networks were refusing to use the results at first. The computer made an early prediction, and the networks didn't even put it on the air until later on because they just didn't believe it.

Several exhibits show the evolution of card I/O technology, from the original semiautomatic sorters in solid oak cabinets through the standard automatic sorters still found in universities nationwide to the final models of the card era. A small pile of tiny 96-col. cards remains from IBM's System/3. They never caught on, and IBM introduced the first floppy disk the following year.

BELL: I was fortunate enough not to deal with cards much. I did one year as a Fulbright scholar and used cards all year. I swore I would never punch another card.

Then I went to Carnegie-Mellon University in 1966 as a professor, and they had an IBM machine with cards. I decided to write a book instead of computing — there was no way I was going to put cards in a hopper again.

I was spoiled. I had just built the first time-sharing machine at DEC, so I really didn't believe in batch processing at all. All the DEC machines were interactive, and we believed in having people talk directly to computers.

But the general level of user-friendliness was still quite low at that point. The Apollo Guidance Computer here was used in the first Apollo space vehicle in 1962. Unfortunately, somebody took a piece off it, so we had to cover the console with plexiglass.

Below it, a [Hewlett-Packard] 150 computer performs the same function as the Apollo. When people play with it now, they say, "Oh, this is awful. The human interface is terrible." We answer, "Yeah, that's the way it was." They ask,

"How did they ever really control the spacecraft?" With great difficulty.

Also while I was at Carnegie-Mellon in the early '70s, I went to a seminar on IBM's minicomputer. It was odd — they had a System/3, and on it was this card reader with these little, nonstandard cards IBM was introducing. And I thought, "Oh my God, don't they know? Cards are dead."

What happens in every technology is somebody tries to make the ultimate version, and it's an absolute disaster. These cards are a perfect example. Just when it was clear that there was no use or need for cards, they introduced these new 96-col. cards. If they weren't as big, the logic went, you could have a smaller card reader, and it could be cheaper. That was all the little cards had to recommend them.

The trick in any technology is knowing when to get on the bandwagon, knowing when to push for change and then knowing when it's dead and time to get off.

That's getting on the right bandwagon. The other trick is not to get on any wrong wagons.

The Viatron 21 terminal is an example of getting on too early. Viatron introduced a CRT, a processor, a keyboard — a whole data entry device for $40 per month, which was absolutely unheard of. A $1,600 device in 1968. The museum has a copy of the advertisement that ran in *The Wall Street Journal*.

This was one of the famous fiascos in selling. The company went public and sold stock, and the stock prices went out of sight because of this revolutionary data entry device. The problem was it was too early. You couldn't build it using the MOS technology they had then. They sold thousands, but they couldn't deliver any of them. The technology was too immature.

A glass case packed full of artifacts — components, posters, books and sketches — fills one wall of the museum.

BELL: The purpose of this exhibit is to mark a period, 1950 to 1959, and to show a range of firsts, from basic technology to applications. The exhibit shows a complete census of all the machines installed by 1950.

As time went by, you can see there was an exponential buildup of computer installations. About 10 machines were installed during '51. They were all prototype machines. Twice that number was installed in '52 and twice that number again in '53.

There's another theme that's important. A time period of approximately 12 or 13 years shows up over and over again in the development of computing. It shows that things really don't change that fast. For example, it took that long to get the transistor into computers in full scale.

In this museum case lies the patent for the first point-contact transistor, which was filed in June 1948. By 1960, all the machines were transistorized, but that was a full 12 years from the invention of the device. Twelve years of hard work and production so you could produce the transistor, so people understood them, so the circuits got done and so on. It just took that long.

In 1959, the Noyce patent was filed on a new way to build transistors — the planar process. That was the beginning of the integrated circuit, but they weren't really produced until '67 to '68 — sort of a half-cycle. On the other hand, IBM's first integrated-circuit computers didn't appear until 1973. That's a full 14-year gap.

In 1960, as the exhibit shows, there was an incredible number of new machines introduced, marking the second generation — the Control Data Corp. 1604 and 160, the beginning of CDC; General Precision's new machine; Sperry Rand's solid-state machine, Univac; Philco Corp.'s transistor machine that put the company at the forefront; IBM's workhorse, the 1401, plus the 7070 and 7090, a real classic; and the DEC PDP-1, the beginning of DEC.

These machines formed the basis for the next 10 years of computing.

That was also the time when I said, "We're not going to have any more modified, kludgy typewriters on our computers." The next machine I designed had a Teletype on it. The next

one after that was when we started using the ASR33.

In the same case, artifacts from the Atlas project include only a single board and a magazine article about the breakthrough by engineers in England.

BELL: Another fascinating introduction during this early period was Atlas, designed at Manchester University. I saw it in '61 and the museum has some artifacts from it. Atlas was the first virtual memory machine, using paging.

Again, the 12-year time delay for a major product introduction — Atlas came out as a research machine in '61, but Manchester's first machine ran in '49. It took them that long to find that two-level store is what you want as a programming environment. DEC started building computers in '60, and by '73, we had a good virtual memory on the PDP-10. We were building minis — or what became minis — in 1966, and the PDP-11 had a good virtual memory on it by '78, when VAX was introduced — 12 years again.

Personal computers of all shapes and sizes crowd the PC Gallery. Whereas many regard the personal computer as a relative newcomer, some of these machines have the look of old-guard computers.

BELL: In the PC Gallery we have one of the Lincs [Laboratory Instrument Computers] that came out in '64 and which I think of as the first personal computer or scientific workstation. It had a personal filing system, keyboard and interactive display, and it was transportable. It cost about $40,000. Linc marked the beginning of a line of computers that included the Linc-8 and PDP-12 for personal, scientific and interactive computing. There are still Lincs in use.

Linc has all the attributes of a personal computer. It's for one person, it's interactive, you can go automatically from program definition to execution without any intermediate paper tape or cards or anything like that. But the main thing is it was used by one individual.

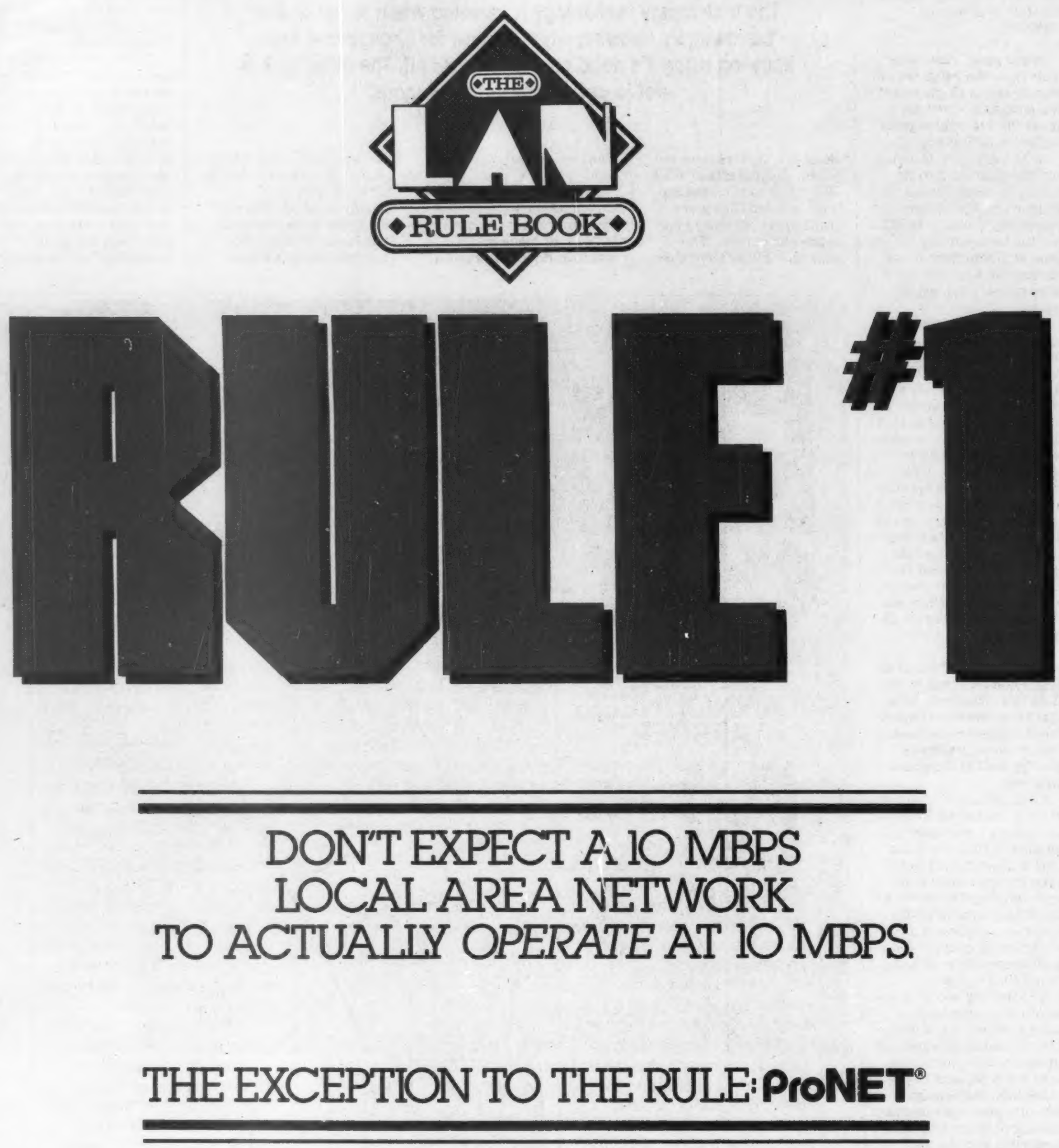
I think the issue of defining a personal computer is really one of scale. How much are you going to pay for a computer for one person? And what does it do?

The purpose of this exhibit is to display things you can't see in stores or in schools. It includes the first personal computers, like Linc and Altair, Apollo's first workstations and other artifacts. All the machines should have their skins off, their insides exposed. Computerland's Bill Millard, who is on the museum's board, has given a grant to collect and to enhance the exhibit. The main thing is to have a definitive, scholarly collection.

From the outset, personal computers were driven by memory technology. In 1975, a 4K memory chip was introduced, and the Altair was built using first a 1K and then the 4K chip. In 1978, the 16K chip was quickly incorporated into the Apple II. In 1981, the IBM Personal Computer came out using the new 64K chip, and then in '84, the 256K chip begot the Personal Computer AT and the Macintosh.

Furthermore, I don't believe anyone really invented the personal computer. "Invention" is too strong a word for it. A lot of things are called inventions when, actually, they were inevitable. I believe technology is a driving devil. It conspires, and if there's a concept half there or a computer half designed, technology will complete it.

The trick in any technology is knowing when to get on the bandwagon, knowing when to push for change and then knowing when it's dead and time to get off. The other trick is not to get on any wrong wagons.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In retrospect, for example, I don't look at the microprocessor as an invention. It was something we were all trying to do for a number of years. One day the technology reached a point where it could be done. In this case, it was a conspiracy between a good chip and adequate memory.

Apple happened to be the first to put that combination into a machine. I don't want to discredit them totally and say, "Oh, they were just a bunch of assemblers." They did a very nice job. The Wozniak disk controller was a very neat little piece of logic. But it was the 6502 processor, the 16K-byte memory chip and that disk controller that conspired, along with the idea of open architecture, in the first Apple computer.

I'm strictly an evolutionist. Get an idea and keep working on it. In the computer industry, we're not idea-limited, it's just a question of pulling the ideas together. The machines that we can build now with the new technology are fantastic. We're anticipating machines that will execute 100 million to 1K million instructions per second.

The Computer Museum honors Seymour Cray with his own exhibit, titled "A man and his machines." Museum curators name Cray the "undisputed leader in the design of the most powerful computers."

BELL: Cray has built the world's fastest computers for 20 years. That's absolutely amazing. He has also produced an incredible string of ideas and basic technology. The reason he has been able to stems from his breadth, starting with the basic physics of the devices, of cooling, of wiring and computation, on into knowing how to build a compiler and operating system.

If you look at Cray and what he has done, you end up with a lesson on how to stay out of organizations. People get sucked into them. Cray stayed out of large organizations: first, at CDC, by getting out of Minneapolis and going to Chippewa Falls, Wis. It was far enough away that people weren't coming to visit him all the time. He couldn't go to meetings.

He could never have built the 6600 in Minneapolis. And then as Cray Laboratories grew, he must have seen the same thing happening and said, "Gee, I've got lots of organizational responsibility, and the way to handle that is to split myself off again."

Organizations, no matter how tenuously connected, all start sucking up your time, and basically people don't have enough time for both computers and organizations.

The Cray exhibit is dominated by the hulking remains of the first CDC 6600. Introduced in 1963, the 6600 was a product of Cray's Chippewa Falls lab and ran three times faster than IBM's Stretch.

BELL: CDC's 6600 No. 1 — a Cray brainchild — is preserved here. When the 6600 was announced, I remember being just awestruck by it. I put it with Atlas as one of the greats.

The 6600 represents special creativity in a number of aspects: It executed many instructions simultaneously, and they were all interlocked. Cray had the idea of separate I/O computers and, of course, his [reduced instruction set computer (RISC)] architecture. For the 6600, they had evolved the circuitry enormously. This was the fastest machine running at the time, with a very respectable clock time even by today's standards — almost a 40-MHz clock.

I love [IBM President Thomas J.] Watson Jr.'s comment about the Cray 1 announcement in '63, posted here: "I understand that in the laboratory developing the 6600 there are only 34 people, including the janitor. I fail to understand why we have lost our industry leadership position by letting someone else offer the world's most powerful computer." That says it all.

The museum's collection includes production Model 17 of the PDP-8, introduced in 1964 at $18,000. The PDP-8 was designed by Edson de Castro (now president of DG) and engineered by Gordon Bell as an outgrowth of the PDP-5.

BELL: The PDP-8 was the first minicomputer. The reason it can be called a minicomputer is that it was built small enough to fit in a cabinet, and therefore it became a component to other systems. Furthermore, it was fast and easily mass-produced. The PDP-5, its predecessor, came out about two years earlier. It was the forerunner of the PDP-8, but I don't classify the PDP-5 as a minicomputer simply because no one integrated it with other systems.

The PDP-8 was implemented in a number of other technologies. By 1978, it was on a single chip that Intersil [Systems, Inc.] built. In fact, the number of sales of the PDP-8 has been higher in the last three or four years than at any other time because it's inside a word processor — the Decmate. So this one machine has lasted 20 years. Not bad.

....

> "*Thank you for your computerized letter asking me the role computers play in society, how I use them at home, how they have changed my life and how I feel they will change society in the 21st century. I do not own a computer. Maybe one of the reasons is that if I put a name like Erma Bombeck into my computer, it would come out 'Dear Mr. Bombeck,' as your letter did. I don't think computers will make it in this century — or the next one — until they know the difference between male and female.*"
>
> ERMA BOMBECK

Eniac, where are you now? Pieces of it still working

BY MICHAEL SULLIVAN-TRAINOR

Though its plug was pulled more than 31 years ago and its parts scattered among a host of collectors and historical institutions across the country, Eniac, or at least part of it, is still capable of operation.

The majority of the computer, once considered the marvel of the age, is stored away or on display at the Smithsonian Institution in Washington, D.C. A portion of it is also preserved at its birthplace, the Moore School of Electrical Engineering, at the University of Pennsylvania. Other computer enthusiasts have collected pieces and stored them at the U.S. Military Academy at West Point, N.Y.; the Fort Carson Museum, Fort Carson, Colo.; and the Los Alamos National Laboratory, Los Alamos, N.M. There were even parts on display for a time at the Computer Museum in Boston.

But out of all these collections, there is only one place where part of Eniac still operates on an infrequent basis. The pieces, two small accumulators, are housed in Angell Hall at the University of Michigan, where from time to time they are used to run computations to demonstrate how the first large-scale electronic digital computer actually worked.

Forty years ago, Arthur Burks, then a 31-year-old engineer, was a member of the 50-person team, led by J. Presper Eckert and John Mauchly, that built Eniac. Today, Burks, a 71-year-old professor of philosophy, electrical engineering and computer science, still maintains the accumulators to give demonstrations to his computer history classes at the University of Michigan.

"Only an old engineer would have the interest and the ability to revive the original pieces of Eniac and get it working again," says Bruce Brummer of the Babbage Institute at the University of Minnesota.

The pieces are two of the 20 original accumulators that made up Eniac's memory. They logged a total of 80,000 hours of computation during nine years of useful life as part of the original machine. Now, though the storage power of Eniac is available in a hand-held calculator, the accumulators are still capable of storing three decimal digits each and efficiently computing a mathematic result, according to Burks.

Each containing 100 of Eniac's original 18,000 vacuum tubes, the accumulators received their information for computation from the computer's large multiplier. To replace this device, Burks has installed two Digital Equipment Corp. control modules. Built in the late 1950s, the modules feed signals to the accumulators in a manner similar to Eniac's multiplier.

The computer now operates at a very slow average speed of 5,000 pulses per second, compared to Eniac's original standard speed of 100,000 pulses per second.

Despite its small size and unusual combination of parts, the system operates in the same manner as the original Eniac. To accomplish a calculation, Burks flips switches on each accumulator, corresponding to the digits and operations sign. The answers are represented by neon lights that flash in positions corresponding to digit locations.

In 1949, Burks came to University of Michigan to pursue his doctorate in philosophy. Though an avid researcher of computer history, Burks says that he did not anticipate the developments that have taken place in the 40 years since Eniac.

"When we were building Eniac, some people recognized that the fundamental physics allowed one to use much smaller components than the vacuum tube, but I don't know of anyone who anticipated how fast this revolution would go," he says.

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